July 1993 Issue #24

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Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

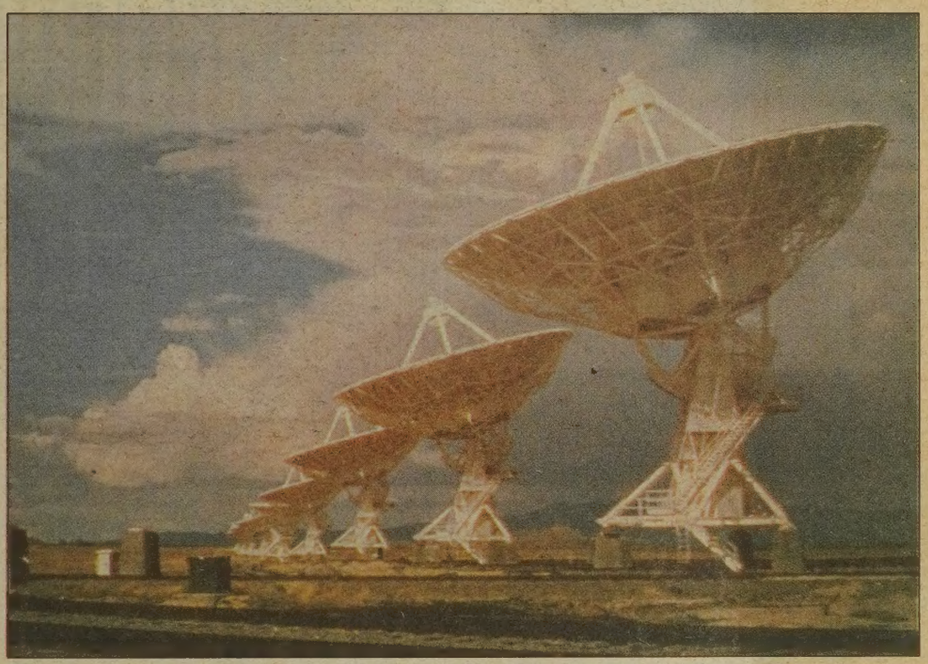
in this issue

Very Large [illegible] Radio Sky Survey

If sky surveys are the lifeblood of astronomy, we are set to receive a major transfusion. The National Radio Astronomy Observatory (NRAO) is about to embark on a major undertaking utilizing the Very Large Array (VLA) radio telescope in New Mexico. Observatory officials say thousands of hours of observing time will be invested in an effort to catalog some two million radio-emitting astronomical objects.

The data from this survey is expected to provide a valuable new resource for astronomers, physicists, and students worldwide. According to Paul A. Vanden Bout, NRAO Director, the survey will be made in the 21cm wavelength band (1.4 GHz), and will cover approximately 5/6 of the sky. "With the increasing importance of multiwavelength astronomy and large astronomical databases, the NRAO has decided that it is time for an all-sky VLA survey," says Vanden Bout.

"Surveys are the lifeblood of astronomy," says noted astro-investigator Robert Becker of the University of California at Davis and Lawrence Livermore National Laboratory. "Astronomers cannot carry out experiments in the laboratory—they must rely on nature to provide them with a variety of ongoing experiments. Surveys are, in effect, a catalog of experiments available for astronomers to study."



Eye on the sky: The VLA radio telescope in New Mexico is sensitive enough to pinpoint distant galaxies at radio wavelengths. (Photo courtesy NRAO/Assoc. Univ. Inc.)

The VLA, which opened in 1980, is one of the world's premier radio telescopes, using 27 dish antennas, each 25 meters in diameter, arranged in a "Y" configuration on the plains of St. Augustin in west-central New Mexico. The precise configuration is changed every four months by transporting the antennas along railroad tracks and placing them on concrete pads distributed along the arms of the "Y."

The usefulness of such sky surveys is demonstrated by the Palomar Sky Survey, a photographic mapping project (optical wavelengths) conducted in the 1950s. The results from the Palomar Survey have been used in thousands of astronomical research projects. The results from the VLA surveys will be made available as soon as the information is collected. For more information, contact: *The National Radio Astronomy Observatory, P.O. Box O, Socorro NM 87081-0387.*

New Repeater and Packet Rules Proposed

The FCC has taken a long-awaited step towards establishing new policy for ham stations involved in automatic message forwarding. The commission has adopted its Notice of Proposed Rulemaking—a measure which foreshadows new regulations which will hold repeater control operators harmless for any prohibited communications instantly retransmitted through the repeater.

Under the new rules, only the originators of instantly-retransmitted communications are to be held accountable for content violations flowing through a repeater. But when it comes to packet, the FCC wants to hold both the originating and first forwarding station licensees responsible for prohibited communications. The idea is that a packet message could be reviewed, but repeater traffic is instantaneous.

Under the rules currently in effect, each amateur station is fully responsible for assuring that the contents of every transmission from his or her station complies with the rules. Generally speaking, this was never a problem for hams until the advent of high-volume, high-speed digital message forwarding systems. *TNX W5YI Report, Vol. 15, April 15 1993.*

Consolidating VE Programs

Novices may soon be folded into the same licensing examination process as everyone else, under an FCC proposal now under consideration. Currently, there are two different examination programs in the Amateur Service. For years, Novices have been informally tested by two volunteers. The Technician through Amateur Extra Class candidates have been tested under the VEC system—using teams of three accredited Volunteer Examiners. The three are managed by a Volunteer Examiner Coordinator who acts as a liaison between the VEs and the FCC.

Apparently, the Commission likes the way that the VEC program is going, because the rate of errors has plummeted and the system is saving taxpayers an estimated $1 million each year. The

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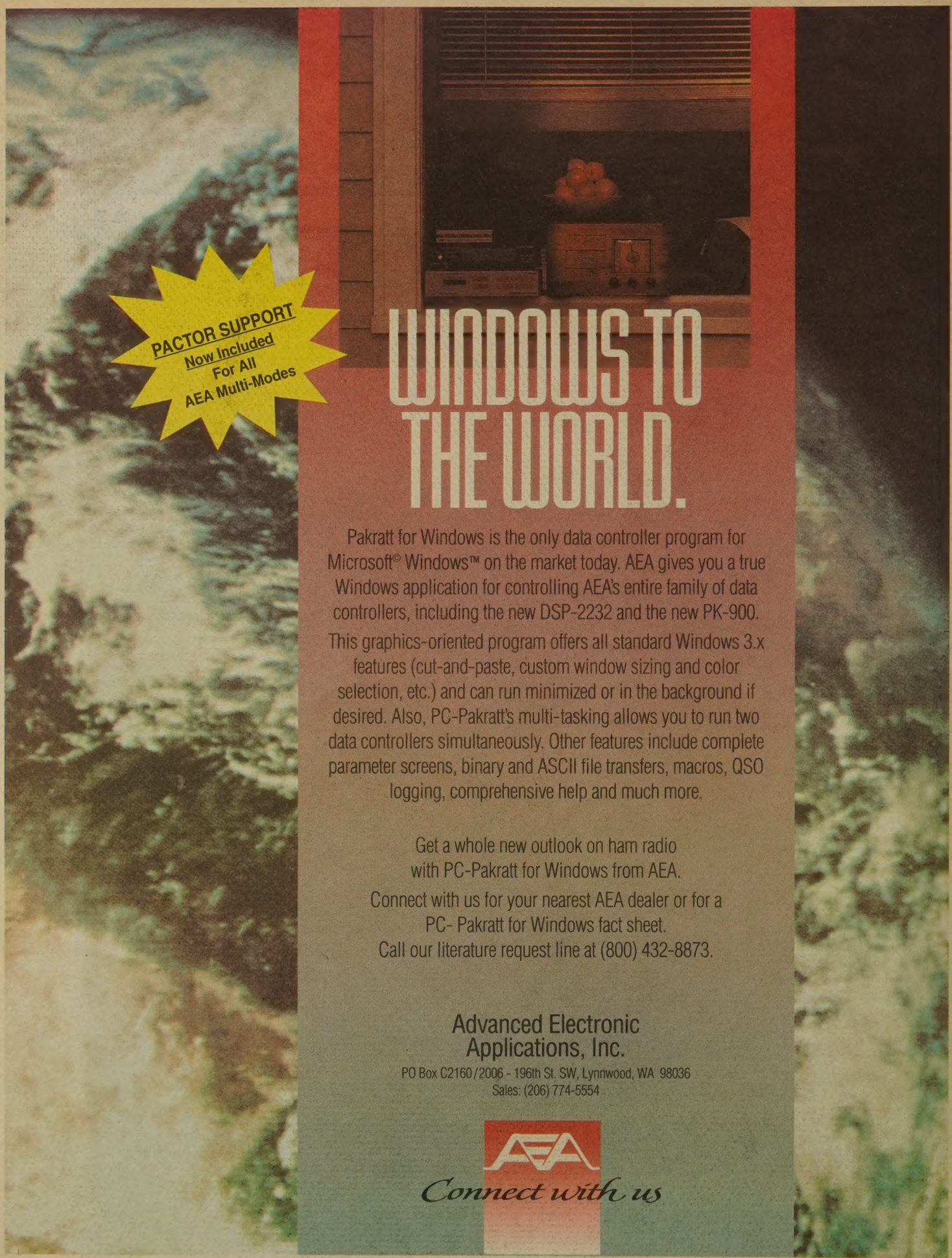
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QLF

by Wayne Green W2NSD/1

DXing On 75m

The BMT Brighton Line subway went by the back of my folks' house in Brooklyn, with the Avenue M station down at the corner of our block. The trains were on a hill, with trees all along the fence. This turned out to be a great place to string a half-wave folded dipole for 75m. The only problem was that my signal would drop a bit when a train went by.

My rig started with a Millen Vari-Arm VFO and ended with a pair of 203Zs running a nice cool AM kilowatt. I hung around 3800, the low end of the band, looking for DX. One of my fellow DXers was Sam Harris W8UKS, out near Cleveland. Sam was running a Collins 32V barefoot . . . maybe a hundred watts or so . . . but he had one whale of a signal. It was his three-element vertical beam that did it. I'd hear him talking with a ZS6 in South Africa and try to break in. The ZS would mention that there was a faint heterodyne on Sam's signal, and I'd be let into the conversation.

In 1951 I landed a job as a TV director with WXEL in Cleveland, so I took along my "portable kilowatt" . . . a BC-459 VFO and a pair of 813s . . . so I could keep in touch. One of my first moves was to visit Sam. His place was impressive. He'd started to build a house and got as far as the basement, which gave him and his family enough room to live temporarily. Then came his 120-foot tower. He hung two wires out 45 degrees from the top to make a three-element beam. When he wanted to change the beam's direction he'd run out and move the two wires.

Sam had a beard, which was most unusual in those days, and a wonderfully dry sense of humor. Sam had a slight problem. A psychological problem. He *had* to have the biggest signal in the world on any band he was on.

After about eight months as a TV director I decided that was a lousy job and moved back to Brooklyn. I remember it was during the Sweepstakes contest because I operated from Cleveland as W2NSD/8 in the first weekend of the contest. A couple days later, as I was moving back to New York, my new call arrived, so on the second weekend I operated as W8NSD/2 from Brooklyn.

In 1955, when I took over as editor of *CQ* I immediately signed up Sam as my VHF editor. Sam got a job with Microwave Associates, near Boston, so he moved to nearby Medway. He had a house way out in the woods, with a quarter-mile dirt road driveway. This gave him the room he needed for some really big antennas. It wasn't long before he had rigged up a barrage of yagi antennas on booms. He used an old Model A truck on rails, powered by an electric motor, to rotate the monster, and soon W1FZJ was pioneering 2m moonbounce. Sam somehow managed to also get W1BU as a call.

In 1962, shortly after starting *73*, I moved to New Hampshire, where I'd have more room for antennas. In short order I had a couple of towers up and some muscle on 2m and 20m. My 96-element beam was no match for Sam on 2m. And he was running 10 elements on 20m, so he was crushing me on that band, too. I had to do something about that. The something turned out to be a nice little cottage with four acres way up on the highest mountain in Southern New Hampshire, Mt. Monadnock. I soon had four towers set up. One had a 400-element beam for 432 MHz. Another had a 200-element beam for 220. A third had a 32-element collinear for 6m. The monster was a 336-element beam on 2m, with the top 48 elements rotatable. This beam, plus my kilowatt amplifier, modulated by about 2,000 watts of audio, reached down the coast at least 600 miles. I could talk with "Twoers" down in West Virginia. I had a good friend down in Hampton, Virginia, who said my signal never went below S7, even when the band was stinko. I sat there and worked 2m stations by the hundreds, working my way down the band.

Sam gave up and moved to Puerto Rico to work on the thousand-foot dish at the Arecibo observatory. He soon had it tuned up on 1296 MHz and was knocking 'em dead via moonbounce. He had the biggest signal in the world on 1.3 GHz. I remember visiting Sam and talking with HB9RF, who I'd visited just outside of Zurich, via the moon.

Alas, between endless cups of coffee with an inch of sugar in the bottom (diabetes!) and his smoking, Sam died. His wife, Helen W1HOY, carried on with his world's loudest signal on 6m, but without Sam, she died not long after he did. They were good friends and I enjoyed visiting and talking with them.

Sam invented the parametric amplifier, a little gadget which gave our radar systems a big edge over other countries. He called me one day and said he'd done it on 6m. I published his article on the invention, but at first people thought it must be an April Fool's joke. It couldn't work. But it did and made Microwave Associates (later M/A Com) millions.

Getting back to 75m DXing, one of our ways of getting more contacts was to go down to 20m, make contact with someone in a rare country, and then get him to come down to 75m and talk with us. When conditions were good we could talk anywhere in the world; it was just a question of getting the DX to go down to 75. Heck, when I was visiting Ray Naughton VK3ATC in Birchip, Australia, we contacted W2NSD/1 on 20m and my home station was coming through S9+. So we decided to try 75m, just to see. S9! What a kick that was. Ray had been working the US on 2m moonbounce with his humongous cubical quad antenna system, so I had to pay him a visit and take some pictures.

What happened to my dream station up on the mountain? The ARRL put it out of business for me . . . but that's another story. I'm sure you don't want to hear about the rotten things the League has done. Let's stay with happy things . . . the fun of amateur radio. It's been a lifetime of fun for me . . . and an opportunity to make some wonderful friends . . . all over the world.

DXing on 75m is great fun, and not easy. Give it a try and see how you do. RF

Inductance

by Larry Luchi W7KZE

[Editor's Note: This technical discussion of inductance is a bit more advanced than what we usually publish in Radio Fun, *and it may leave some of you in the dark. If so, read it through a few times—slowly—and things should begin to sink in. If you want to get the most out of amateur radio, you've got to really understand this stuff—not just memorize a bunch of answers for a test. We've asked Mr. Luchi to prepare a series of articles focusing on various electronic components and their properties. We'll publish them from time to time, and if you stick with them, you'll be well on your way to a solid foundation in electronics.—David N1GPH]*

This article discusses the inductance of coils and chokes and their basic theory in terms of mutual inductance. Power transformers and their various ratios and losses are outlined. The idea of inductive reactance and its calculations are developed, along with the phase relations of inductive circuits.

In my last article I discussed capacitance, where the electrostatic effect produced by AC current leads voltage in a capacitive circuit. An equally important aspect of the operation of a coil is its property to oppose any *change* in the AC current through it. This property is called *inductance*.

When a varying AC current of electrons starts to flow along any conductor, a magnetic field starts to expand from the center of the wire. These lines of force move outward, through the conducting material itself, and then continue into the air. As the lines of force collapse through the conductor, they induce an electromotive force (voltage) in the conductor itself. This induced voltage is always in a direction opposite to the direction of the varying AC current flow from the source. Because of its opposing direction it is called a *counter voltage (cvoltage)*, or *back voltage*. Figure 1 shows a simple example of the lines of force in a conductor.

The effect of this backward force built up in the conductor is to oppose the immediate establishment of maximum varying AC current. This is a *temporary* condition, depending on the position of the sine wave in its 360-degree rotation. When the current eventually reaches a steady value in the conductor, the lines of force will no longer be in the process of expanding or moving and a counter voltage will no longer be produced. An example of this would occur if a DC voltage was applied to a conductor. At the instant when current begins to flow, lines of force are expanding at the greatest rate and the greatest value of counter voltage will be developed. At the starting instant, the counter voltage value almost equals the applied, or source, voltage (Figure 2). This counter voltage value is said to be stored in the magnetic field.

The current value is small at the start of current flow. As the lines of force move outward, however, the number of lines of force cutting the conductor per second becomes progressively fewer and the counter voltage becomes progressively less. After a period of time, the lines of force expand to their greatest extent, all counter voltage ceases to be generated, and the only voltage in the circuit is that of the source. Maximum current can now flow in the wire or circuit, since the inductance voltage is no longer reacting against the source voltage. Figure 3 shows the expanding magnetic field.

Self-Inductance

When the switch in an AC current circuit is suddenly opened, the switch breaks the circuit at that instant and the current due to the applied voltage will cease abruptly. With no current to support it, the magnetic field surrounding the wire will collapse back into the conductor at a tremendously high rate, inducing a high-amplitude voltage in the conductor. Originally, when the field was built outward, a counter voltage was generated. Now, with the field collapsing inward, a voltage in the opposite direction is being induced. This is termed a *counter-counter voltage*, but is usually known as a *self-induced voltage*.

From this comes the definition: *Inductance is the property of any circuit to oppose any change in current, and in which energy is stored in the form of an electromagnetic field.*

The unit of measurement of inductance is the *henry*, defined as *the amount of inductance required to produce an average counter voltage of one volt when an average current change of one ampere per second is under way in the circuit.* Inductance is represented by the symbol L in electrical problems, and the henry is shown by H.

Typical Coil Inductance Values

Air-core coils for RF applications have L values in millihenrys (mH) and microhenrys (μH).

$1\ mH = 1 \times 10^{-3} H$

$1\ \mu H = 1 \times 10^{-6} H$

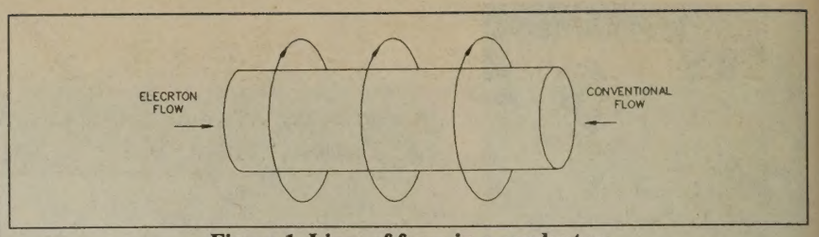

Figure 1. Lines of force in a conductor.

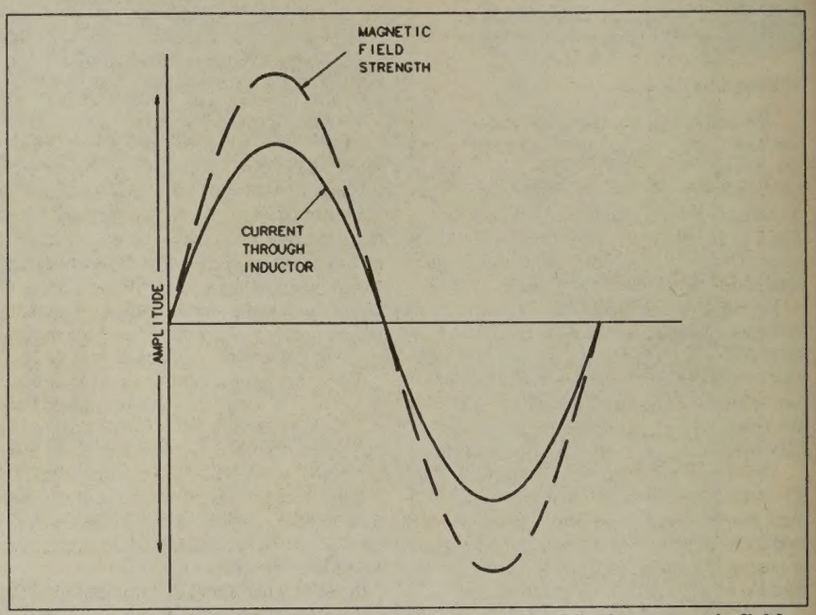

Figure 2. The AC counter voltage is said to be stored in the magnetic field.

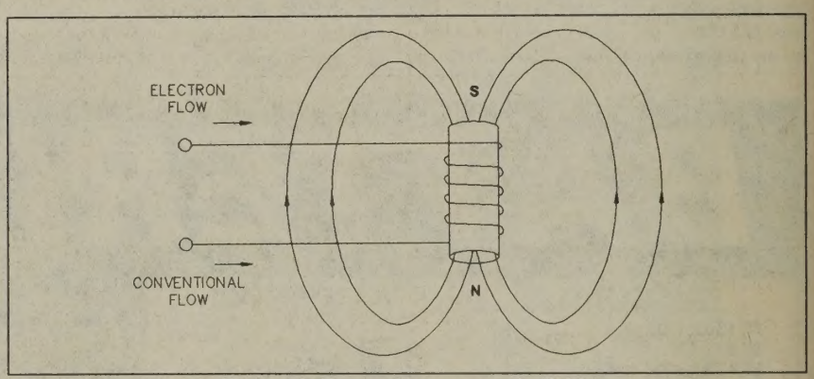

Figure 3. Expanding magnetic field.

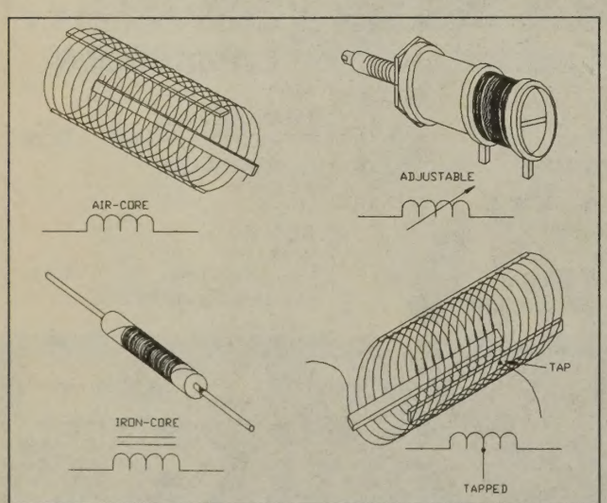

Figure 4. Inductors with their schematic symbols. Left, top: fixed air-core; right, top: adjustable ferrite slug coil; left, bottom: iron-core audio choke; right, bottom: tapped air-core.

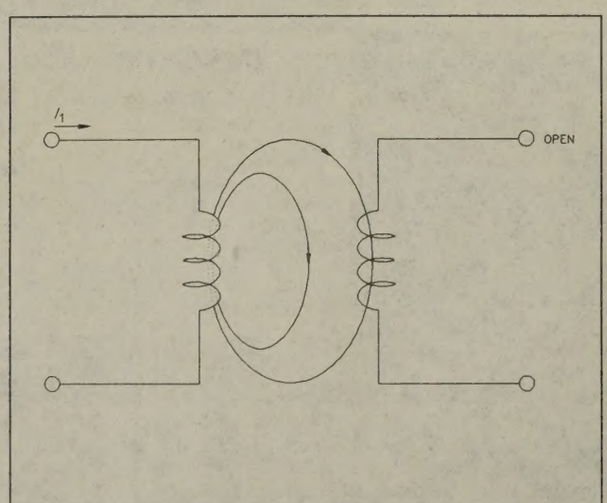

Figure 5. Coil L_1 is connected to the source that produces a varying AC current in the turns. Induced voltage is present across the secondary.

Mutual Inductance

When the AC current in an inductor changes, the varying magnetic flux or lines of force can cut across any other inductor nearby, producing induced voltage in both inductors. In Figure 5, the coil L_1 is connected to the source that produces a varying AC current in the turns. The windings in the secondary are open and not connected to L_1, but the turns are linked by the magnetic field. A varying current in L_1, accordingly, induces voltage across L_1 and across the secondary. If all the flux of the current in L_1 links all the turns of the secondary, each turn in the secondary coil will have the same amount of induced voltage as each turn in L_1. Additionally, the induced voltage in the secondary coil can produce current in a load resistance connected across the *open* terminal.

Inductances in Series

Electronic circuits often have two or more inductances in them. Whether the magnetic fields of the two coils interlink decides the effective amount of inductance presented to the circuit by the coils. The derivation of total inductance is too complicated to show here, so

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letters

Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

Robert Weimer W5DPO, Albuquerque NM The March issue of *Radio Fun* was the most valuable! "Handy-Dandy Coax Adapter": I use PL-239 and BNC connex. No more hunting for adapters. "What Else Can You Hear on Your 2 Meter Rig?": Good to know.

John Swain KE2XX, Canaseraga NY Thank you for the great articles in *Radio Fun*. I like the format of your magazine.

In future issues would you please list sources for parts in your construction articles? I plan to build the trap dipole; however, no one seems to stock transmitting capacitors. There was a manufacturer on Long Island willing to sell me some but he wanted $47 each unless I wanted 500. Hamfests do not generally have them. *[Ed. Note: He has since obtained capacitors from another ham.]*

Other hard-to-find parts are large air variable capacitors and large roller inductors. There are other parts that may be difficult to find as well. If sources were listed it would be less frustrating.

John—If we didn't list part sources it was a mistake. We try to make sure every *construction project gives parts sources. Sorry!—David N1GPH*

Don Stepka, Rochester NY Thanks for the May "QLF"! If only those who need it so badly would hear you!

I'm a recent codeless Tech, disgusted with the state of amateur radio (particularly in the US). Not that I didn't know what I was getting into—I've listened sporadically all my life—but it's almost impossible to have conversations with my friends without at least several lids joining in (and we're very creative at finding unusual frequencies and modes to discourage such uninvited guests). I've found no reasonably courteous (nor effective) way to ask others to "butt out," so I have taken to responding "negative copy" and signing clear, postponing my own conversation for a later time. I'm seriously considering encryption, or at least coding digital audio in some obscure but accepted format (to preserve at least the pretense of legality).

The unfortunate truth is that many, many hams are uninteresting (and uninterested) nerds and dweebs with poor social and communications skills, who are as painful to deal with in person as they are on the air. A quick trip to any hamfest will convince reasonably well-adjusted people of this. Duplex channels, desirable as they are (5 MHz splits at high band VHF or UHF work well with commercial repeaters or old-time mobile telephone filterplexers; so does multiband operation), will not change this, nor will video contacts, nor will faxed and downloaded resumés.

While we can't hope to mend the socialization of all hams, I would like to think we can abolish unacceptable operating practices (you didn't mention intentional interference, which I hear nearly every time I monitor domestic HF). I advocate dropping the code requirements completely (requires modification of international treaties, I believe) and adding testing for operating practices. RF

Inductance

Continued from page 4

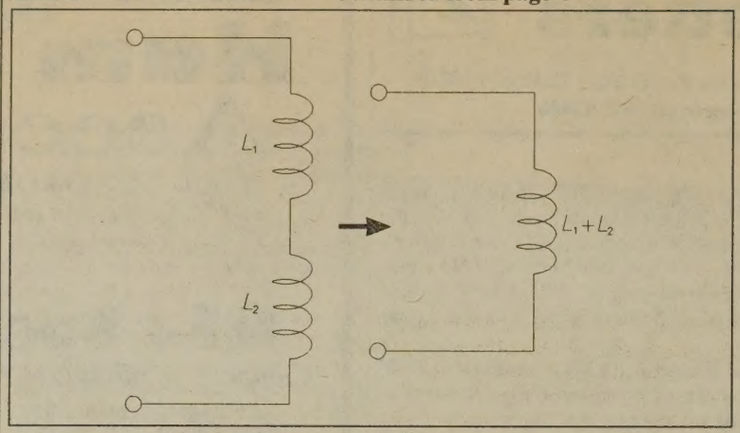


Figure 6. The use of two or more inductances in series is additive.

we will state the following formula without proof:

$$L = L_1 + L_2$$

The final term in this equation may be plus or minus, depending on how the poles of the inductors are aligned. Stated another way, it depends on whether the two fluxes aid or oppose each other. But, in amateur radio the use of two or more inductances in series is additive, just the same as resistors in series. Figure 6 shows this combination.

Inductances in Parallel

In some circuits two or more inductors may be connected in parallel. Then the total inductance is the same as a resistor in parallel, and we apply the product of sums formula:

$$L_{total} = \frac{L_1 \times L_2}{L_1 + L_2}$$

Relative Permeability

From your studies of DC circuits you know why some materials are magnetic and others are not. If you recall, the atoms of a magnetic material can align themselves to aid the magnetic field. When these atoms are aligned the total flux increases, which means the inductance increases.

Relative permeability shows how easily the atoms of the core can align themselves with a magnetic field. It equals the ratio of the permeability of a material to the permeability of a vacuum. The defining formula for relative permeability is:

$$\mu \text{ relative} = \frac{\mu_x}{1.26 \times 10^{-6}}$$

*where μ_x = permeability of test material, and 1.26×10^{-6} = permeability of a vacuum.

Table 1 shows the relative permeabilities for some materials. The values are approximate, because exact values depend on the grade of the material, its heat treatment during the manufacturing process, and other factors. As shown, air has a relative permeability that is very close to that of a vacuum. Similarly, aluminum and most other conductors act like nonmagnetic materials. The best known magnetic materials are nickel, iron, steel and cobalt. These materials have relative permeabilities from approximately 50 to 5,000. By mixing these materials we can get alloys with even higher permeabilities, such as ferrites, permalloy and supermalloy.

Table 1.

Material	μ
Vacuum	1
Air	1.0000004
Aluminum	1.00000065
Nickel	50
Cobalt	60
Steel	300
Iron	5,000
Ferrites	100 to 2,500
Permalloy	25,000
Supermalloy	Up to 1,000,000

Voltage and Inductance

In my last article, "Capacitance" (May 1993), we learned that the voltage lagged the current by 90-degrees. Figure 7 shows the current waveform where in an ideal inductor the current lags the voltage by 90 degrees.

Coefficient of Coupling

When the varying magnetic field of an inductor passes through another inductor, the changing flux induces a voltage in the second inductor. For instance, Figure 5 shows a current of I_1 in the left inductor. This creates a flux of Φ_1 in the left inductor. Some of this flux passes through the right inductor. This flux is symbolized by Φ_2. The definition of *coefficient of coupling* is the fraction of flux out of the first coil that passes through the second coil. Or, simply put, the fraction of total flux from one coil linking another coil is the coefficient of coupling *(k)* between the two coils.

Tight Coupling

Tight coupling means two inductors have a value of k that approaches 100 percent. Figure 8 shows the usual way to achieve tight coupling.

The two inductors are wound on a magnetic core. Because of this, most of the flux produced by the first inductor passes through the second inductor. A ferromagnetic core typically has a coefficient of coupling between 0.95 and 1. This means that more than 95 percent of the first flux passes through the second inductor.

Figure 8 shows a toroidal coil wound on a core that is curved into a donut shape. Powdered ferrite compounds are usually used for toroidal core materials. The toroid is a highly efficient inductor because there are no breaks in the circular core. All of the magnetic lines of force remain inside the core. This means there is very little mutual coupling between the toroid and other parts of a circuit. RF

Contact Larry Luchi W7KZE at Sno-Isle Skills Center, 9001 Airport Road, Everett WA 98204.

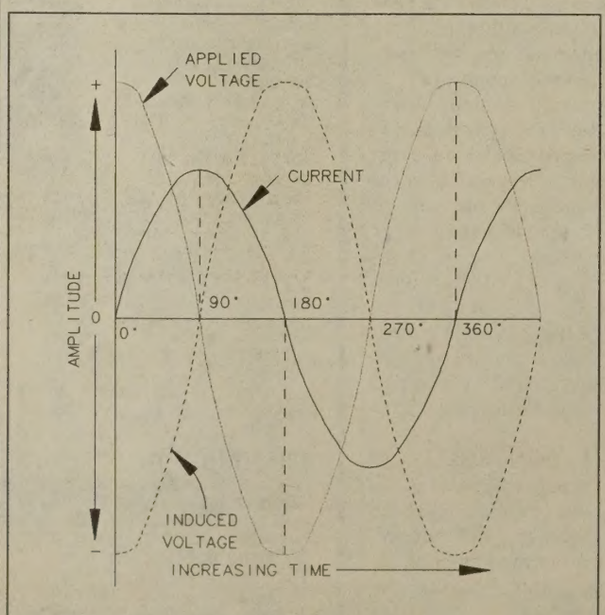


Figure 7. Current waveform where, in an ideal inductor, the current lags the voltage by 90 degrees.

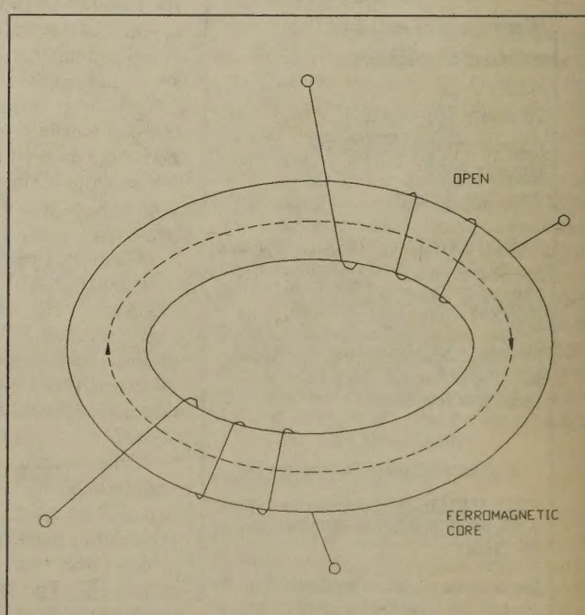


Figure 8. Achieving tight coupling, where the coefficient of coupling approaches 1.

Power Pouch

by Robert C. Green W3RZD

Do you want to eliminate the unending job of recharging those pesky little AA NiCd cells in your handheld?

If your answer is "yes," the solution is simple: Don't use AA cells, use either C or D cells. No, you don't need a hammer to pound them into the cell holder; you put them in a little carrying bag and connect it to the transceiver with a cable. I have used such a bag of batteries for more than a year and it has worked better than expected. When a friend saw it he named it the "power pouch," and that's how this project was born.

Finding Parts Is Easy

You will need a 6-cell C or D battery holder; a pouch that is a little larger than the holder; a small 2-pin male and female plug and socket set that mates; a 4' piece of zip cord; and a spare "HT" (hand-held tranceiver) battery compartment which was designed for replaceable AA cells.

I found a 6-cell C holder in the junk box. The pouch was bought at a K-Mart's camera department. The pouch is 7" long, 3-1/2" wide and 1-1/4" deep, which was big enough to hold the 6-C-cell holder. It has a zipper up one side, across the top and down the other side. Mine is made of a soft leatherette type of plastic and has a detachable shoulder strap.

I purchased the replaceable battery compartment at an amateur radio supply store. Obviously, you need to get one that fits your brand of HT. Mine is an ICOM IC-BP4 battery case which has an inner and outer section which sort-of telescope together. The plugs are easily found at Radio Shack (#274-222). These plugs are commonly known as Molex plugs, but Radio Shack calls them "Polarized Interlocking Connectors." They are sold in a package of one male and one female. They have two pins, and the shells have tabs that lock them in a panel.

Construction

These instructions will work perfectly on the IC-BP4 battery compartment. If you are using another brand, you may have to customize these steps slightly for whatever brand of HT you are using.

First, remove the internal wiring and the cell contact clips from the new HT battery compartment. Orient the inner section and the outer shell of the battery compartment and mark the front side of the inner section. Cut a horizontal slot, just large enough for the back end of the male plug to slide through, in the middle section of the partition that normally holds the two center cells. The front of the plug should face the front of the compartment when it is assembled. Hold the plug in place with 4-40 bolts through holes drilled in the bent-back chassis tabs and the partition. It is necessary to place a 1/8" spacer or nut under each tab on the front side of the partition so the plug is centered front-to-back. Wires are then soldered to the pins and the pins inserted in the plug. The other ends of the wires are soldered to the positive and negative connections on the top of the compartment. Two male and two female pins come with the plug package. I used the male pins in the male plug shell and the female pins in the female plug shell. One end of each plug shell is shaped in a "vee"; I used this end for the positive connection.

Cut an opening slightly larger than the face of the female shell in the front panel of the compartment cover. This opening allows the female plug to mate with the male plug mounted on the internal partition. Cut a "vee" that matches the "vee" on the plug shells in one end of the plug opening to make it easier to align the plugs. Cut off the chassis tabs on the female shell. Snap the battery compartment together and drill a small hole in one end so a #4 sheet metal screw can be inserted. The screw will hold the two sections together securely. See Figure 1.

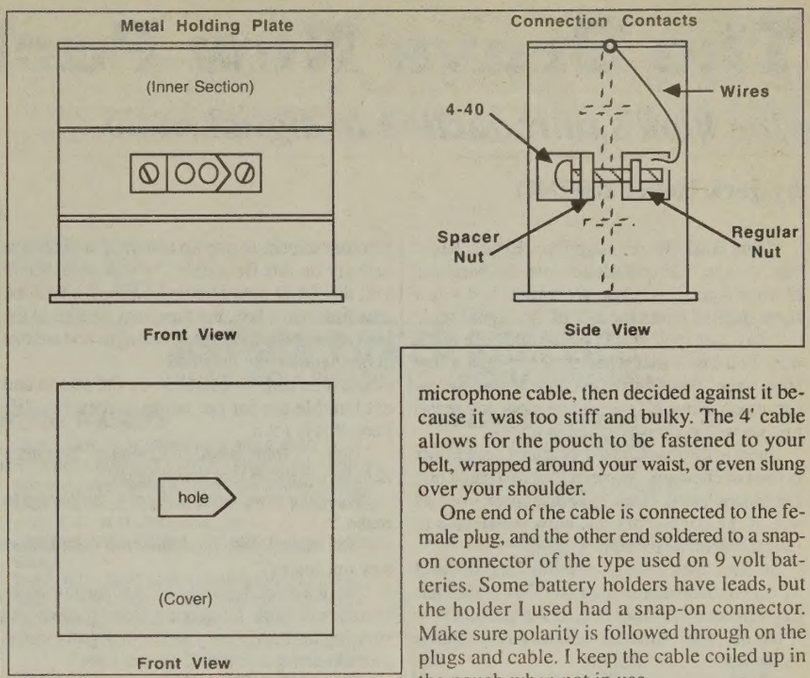


Figure 1. The "Power Pouch."

I made a cable from an "in-the-ear" earphone wire but it proved to be too fragile and broke easily. So I made a rugged cable from a very flexible, small-diameter zip cord, and it still works fine. I thought about using a coiled microphone cable, then decided against it because it was too stiff and bulky. The 4' cable allows for the pouch to be fastened to your belt, wrapped around your waist, or even slung over your shoulder.

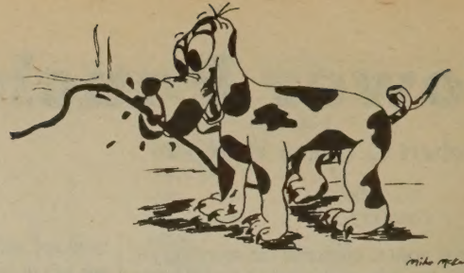
One end of the cable is connected to the female plug, and the other end soldered to a snap-on connector of the type used on 9 volt batteries. Some battery holders have leads, but the holder I used had a snap-on connector. Make sure polarity is followed through on the plugs and cable. I keep the cable coiled up in the pouch when not in use.

Later, when looking through a Radio Shack catalog, I noticed that they do not stock 6-cell C or D holders, but they do stock 2- and 4-cell C and D units. These can be used exactly the same way if they are glued back-to-back and wired in series.

The pouch worked out better than expected for me because either NiCds or alkalines can be used. If alkalines are used there is a higher voltage, 9 volts instead of 7.2, which will give a little more transmitter power and improve the sensitivity of the receiver. In an emergency, carbon or alkaline cells can be purchased at drug and grocery stores and even at filling stations.

All I need now is a portable antenna that outperforms the rubber duckie on my handheld, and can also be stored in a pouch. I guess I had better start working on it now. RF

The Brave New Packeteer



One ham's introduction to digital radio.

by Jack Heller KB7NO

"This is it! We're home free, Elmer. Right here it says, 'Congratulations on the purchase of your Ajax TNC. You are within just a few short steps of being the talk of the digital set.'

"Boy, just look at this well-built little black box. You know that when they say `just a few short steps' you don't even have to read the instructions. Now, if I take it real slow and sensible, we will get this plugged in a jiffy."

Elmer is the shack hound, of course, and Elmer is fond of chewing. "Elmer!! Spit that cable out. Let me look at it. Darn. You must have chewed one of the connectors off. Now we'll have to read the book to see how to fix it."

Seldom does John Q. Antidoc feel the need to read an instruction manual. This is like letting someone boss him around and tell him how to run his radio. After all, he does have a license to do this.

"Well, this may not be too bad, Elmer. Right here on page four they have a schematic. Now this other cable is pretty obvious. It goes from the serial port to this connector right here on the back. The one you chewed up . . . Hmm . . . By golly, Elmer. I guess it came without an end."

John Q. may have to really do a read on this one. At least it is in the privacy of his own shack and Elmer can be sworn to secrecy. It would look bad to have a friend catch him reading the instruction book, and even worse not understanding what he read. Psychology folk usually read something into this behavior pattern, but they don't understand the scientific mind.

"I am beginning to see the logic of this now, little buddy. This little black box is meant to fit all the popular rigs. Says to turn to appendix E for wiring to my GlowWorm II. We're hot on the trail!

"Whoa, it says here I need to build this little PTT driver to make this work. That looks easy enough."

Somehow, John Q's junk box was unable to produce the parts as listed; so the scene reopens in the afternoon as he is just finishing the project.

He picks up the radio and inserts the cables into the mike and audio jacks. "Now we're cookin', Elmer. Let's see, we got audio from the radio to the TNC both ways and, if this all works, it will key the radio when the audio comes from the little black box. Lead pipe cinch."

John Q. gets all the elements in a row and turns on the radio and the brand-new Ajax TNC and his computer and watches. Not much to watch. After the system prompt there is a message with a version number.

"Oh yes! The software on that disk. Elmer! No! Don't even breathe on that disk mailer." John opens the package and removes the disk marked "Starter package—Typing SETUP at system prompts." "Boy, I don't think they translated this in West Germany."

John is an experienced hacker and he has no trouble inserting the disk into his machine and getting the program to install onto his hard drive. He even knows to search for a "Read.me" file and to print it. A good thing, because that is his instruction manual.

The program ran, first kick (or is it boot?). "Look at this Elmer. Now, are we smart, or what?" Hard to impress a dog whose main activity is chasing birds and wondering why he can't fly after them. Computer screens are just too difficult to focus on.

Somehow, John's ecstatic nature wanes a bit when he realizes there must be a few more steps before he is inducted into the Packet Operator Hall of Fame. This screen didn't look like Pete's monitor. Pete had all this stuff in a box down at the bottom of the screen, and there seemed to be other screens to pop up and there was always activity on this frequency, he was sure. There was this DCD light blinking on the front of the new little black box, but there was no sign of the many lines of messages and callsigns and strange abbreviations like Pete had.

Must be time to call Pete on the phone and eat humble pie for not being successful. "Hi Pete, this is John."

"Hey . . . John, what's happening? You need help propping up that tower again?"

"Naw, the tower's okay. I got a confession to make."

"You melted your finals and you want to borrow my spares?"

"No, it's much worse. I can't get my new packet station to work. I was going to get it all up and running and surprise you. Now I gotta come groveling to get you to show me how."

"You got a packet station together? Wow, that sounds like you are ready to have some fun. I'll be right over."

Pete is used to John and his bull-in-a-china-shop approach to setup, and he knew this was going to be another disaster, but then what are friends for? He was there within the hour.

"John, this is great! It looks like it's working already. When did you do all this?"

"Just today." John always wanted to get something right the first time, and he had hoped not to have to call Pete to bail him out. This sound in Pete's voice was a new one, though. It sounded like he may have been doing things right so far. "Thing is, I just get this blank screen. Nothing like yours."

"John, type MH."

John did and a list of callsigns scrolled up the screen. "What's that? Where did they come from?"

"MH stands for `Heard List' and what you see is a list of all the stations that your station has been copying. This is different from mine because yours is a dumb terminal."

John knew it was coming. Now Pete was calling his station a dumb station. "Okay, so how do I make it smart like yours?"

"Oh, it is already smart enough to do what you want to do. Sometime you will probably want to buy some better software to make it easier. Let's look at this and set a few parameters so we can watch it play."

"Parameters?"

"Sure, where is the manual that came with this TNC?"

"Sitting by the printer. There must be 20 pages. I didn't have time to read it. I just wanted to get it up and running."

"Okay. Well John, now that you got past the hardware hurdle it's time for a little serious reading. Twenty pages isn't going to cover much. Look at this list of parameters they gave you."

"Wow, there's over a hundred of them. Do I have to use all those just to send a message out to you? Why doesn't this thing come all ready to play so I don't have to do all that?" Apprehension was setting in fast. John's heels tend to dig in when detailed explanations have to be read and interpreted.

"This whole list is hard John, but we take them one at a time. It will probably take 20 or 30 minutes and you should have a real station here. You and Elmer will be the talk of the neighborhood."

Elmer opened his eyes and sniffed when he heard his name. John hoped he understood Pete was going to fix his station for him. "You want me to get you a root beer while you do that?"

"No thanks, and you just sit down here because you are going to do it, old buddy. You are going to need to get familiar with this if it is going to be your baby. Once you get the parameters in, the TNC should remember them the next time you fire it up. Then you will want to tweak them once in awhile."

This was sounding serious. Maybe this could be avoided. "Pete, maybe I should wait and read this through first."

Pete reads minds. At least he reads this kind of mind. "John, no, if you were going to read it by yourself, you would have done so before you called me. And, to be really honest, you will need help if you read it three times. Now, let's get started. Type MYCALL."

"Okay, now what?"

"Hit the space bar once and type your call."

"Okay, and then?"

"Hit Enter and type MYCALL again and hit Enter."

"Hey, what is that? It printed my call letters."

"Yes, you have to have that in there or the machine won't function. It has to be able to identify itself with your call. You want it to do that and so does everyone you connect to."

"This might get to be fun. Can we hurry through this? Are there some shortcuts?"

"We need to check most of the parameters and set them if this is going to play, so use a little of that patience I have never seen in you before and let's get this done. This is like other computer devices—it needs to be right before it can work."

Pete had been into packet for well over a year. He was well aware of the need to set everything right to get the TNC to perform. He was used to setting his host terminal and found it fascinating to help John and explain what each of the settings were for.

After the first dozen or so parameters Pete had chosen were set, the screen started displaying activity. "Wow, look at that! We must be done. Can we talk to somebody?"

"Hold your socks on. Let's get this done and you can play all night." Pete read and instructed and explained, and the time passed quickly. Finally, it was done.

"Now how do we talk to somebody?"

"You have choices. You can leave a message on the local bulletin board for anyone you know who does packet. You can connect to the local node and see if someone else is connected there and call him. You can watch the screen and try a connect to one of the stations you see on the screen."

"Oh . . . What would you do?" Sweaty palm time. A first connect can be traumatic. "Is this a good time of day to do this?" Maybe this can be worked up to. Or just maybe there is another way. "Maybe you should demo this thing?"

Pete knew this was coming. "No, John. You can do it. Let's connect to the club BBS. Type C, that stands for Connect, and a space and LOCALBBS. Now watch what happens."

They watched, Elmer moved under the table and started to get tangled in a cable, then settled in for extended rest time. John was wondering. It didn't look like much was happening except more callsigns scrolling on the screen, along with strange symbols and letters. Then the monitor sparkled with "CONNECTED TO LOCALBBS."

"Wow. Look at that!" John's dreams were coming to fruition. "But it is scrolling off the top of the screen! Are we off the air?"

"No. You are still connected, but there is a lot of activity on the frequency and you are monitoring all of it."

"Now what?" This was happening just too fast.

"Let's change the monitor parameters. Give it a Control C. That will allow us to tinker."

"But what about those greeting messages that just went by?" John knew somebody was watching his station somehow, and he was going to look dumb.

"Not to fret. Just do it." The Control C brought up the cmd: prompt and MON was entered and subsequently turned off as well as CMON by entering the commands with the OFF typed after them.

"Just great! We killed it! Everything stopped and we can't see the questions they were asking." John was sure the local guys were all laughing hysterically as they watched this from wherever they watched things like this.

"John, it's okay. When you sign on to a BBS for the first time it wants to know about you. This one is very friendly. It is waiting for you to tell it about yourself and your station. Just press N. That stands for New as in New Member. Then hit Return."

Pete managed to guide John through the sign-on trauma with a minimum of anxiety. John was able to answer all the questions until: "'Enter home BBS___' Does this mean I have to have a BBS here at home?"

"No. Just enter the station callsign we are using for the BBS, WX7ZZZ. That becomes the destination for mail that is sent to you."

"Oh, yeah, of course." This was still happening fast. "Now, how do we quit?"

"The fun is just beginning, old buddy. Let's look at the file section. Press W and give it an Enter."

"What's all that? I see AMSAT and RACES and EQUIP and all those other headings. What do we do with those?"

"Those are directories, or in some cases single files, just like you might have on your hard drive that you can download and read and use. See the one that says MANUAL.BBS? If you download that you will have a six-page manual telling you how to use the BBS."

"Do I need that?"

"Do it now. Let's find the command that turns on your printer in this software that came with the TNC and turn that on first. Then we'll use the D command on the BBS and you will have your own set of instructions for the BBS."

The Real Ending

As we can see, this was a great day of learning for John that was made possible by a real Elmer named Pete.

Though most of us need help in the beginning, this packet business is really easier than what this story has depicted. As far as I know, there is no company marketing a TNC that requires more than a few parameter entries after installation.

The intent of the manufacturer in every instance seems to be to make these things as close to "plug and play" as possible. They want each of us to be able to recommend their product to our friends as perfectly satisfactory. This is not a product review, and I hope not to upset any of the manufacturers out there by inferring that these systems are difficult to master.

Digital communications takes many forms and we are fortunate to have so many modes available to us in ham radio. I sincerely hope that anyone reading this who has not taken the plunge will be at least one step closer. There is a whole world of exciting challenges and triumphs to be experienced by braving these frontiers.

Just for the record, I have a dog named Elmer, and he does chew cables. This leads to a lot of controversy around here.

Elmer and I share this packet address: KB7NO @ WA6EWV.#NOCAL.CA.USA.NA; CompuServe 72130,1352. RF

VE Programs

Continued from page 1

Novice testing system has an estimated error rate of nearly 10 percent and data collection has also been a weak point. The commission also hopes to minimize fraud by consolidating the VE programs. *TNX W5YI Report, Vol. 15, May 1 1993.*

Senator Extols Amateur Service

A Joint Resolution (S.J.90) has been introduced in the United States Senate recognizing the achievements of radio amateurs. Senator Charles Robb of Virginia drafted the bill which calls for a national policy supporting amateur radio.

The resolution urges adoption of rules and regulations that encourage the use of new technologies within the Amateur Service. It also requests that any regulations which are necessary at any level of government be crafted in ways that encourage ham radio as a public benefit. *TNX Westlink Report, No. 650, May 27, 1993.*

Special Club Callsigns Approved

The FCC has amended its Amateur Service rules to provide for volunteer organizations to administer a system designed to provide special callsigns to club and military recreation stations. This action was authorized by the Telecommunications Authorization Act of 1992. Organizations selected for the new system will be known as "Club and Military Recreation Station Call Sign Administrators."

To qualify, the club must exist for the purpose of furthering the Amateur Service, must be comprised of at least one percent of all hams licensed by the FCC, and must be capable of serving as administrator in all places where the Amateur Service is regulated by the FCC.

Each administrator will be assigned a block of two-by-three-letter callsigns. Dates for accepting administrator applications have not yet been announced. *TNX Westlink Report, No. 650, May 27, 1993.*

Details Released on 219-220 MHz Access

The FCC has fleshed-out its Notice of Proposed Rulemaking to " . . . provide a secondary allocation for the amateur service in the 219 to 220 MHz band to be used for amateur auxiliary stations (point-to-point) packet backbone and other amateur point-to-point fixed communications." In response to a petition filed by the ARRL, the commission is proposing to allocate, on a secondary basis, the 219-220 MHz band for inner city wideband packet radio networks and other point-to-point fixed operations.

According to the commission, this will (a) relive the congestion in the 222-225 MHz band, (b) encourage the development and implementation of a packet network that can be used for emergency and national defense communications, (c) facilitate connection of local packet nodes to form such a regional or nationwide network, and (d) provide spectrum for exploration of new technology. *TNX W5YI Report, Vol. 15, April 15 1993.* RF

RF review

GAP Antenna Products
6010 Bldg. B
N. Old Dixie Hwy.
Vero Beach FL 32967
Telephone: (407) 778-3728
Price: $249, plus shipping

The GAP Challenger

An easy-on-the-budget vertical antenna.

by Steve Katz WB2WIK/6

Want to tackle those HF-DX bands with a big signal? All the old-timers will tell you to simply install a 70-foot tower with monoband yagis or multiband, interlaced quads for the bands of interest. This only costs maybe $3,000-$5,000 or so, takes about 40 hours of assembly and installation time and will be visible to all your neighbors within about a half-mile radius. Why not? Of course, you'll also probably need a building permit, and maybe a special use permit, or possibly a variance to the local zoning laws, and maybe written statements from all your neighbors within 500 feet or so testifying they don't object to your proposed installation. Let's see . . . maybe you'll also need a good lawyer to help you get this thing through the local courts, especially if anyone objects to your plans. Starting to sound complicated?

Don't let me discourage you from putting up that "killer" tower and antenna system. If you have the time, money and desire to jump on the bands in one huge leap, your efforts will reward you with "big signal" reports and lots of great DX.

A Practical Alternative

But for many newcomers, or those with limited time and budgets (or maybe just limited real estate), there are other ways to enjoy DXing and other fun HF (3-30 MHz) endeavors. How about a vertical multiband antenna?

I know—you've probably heard lots of theories that verticals "radiate equally poorly in all directions" and are just not good performers. Some of those stories are true. You can't expect "big signal on the band" performance without doing at least a little bit of antenna work. And, after all, your antenna is probably the most important part of your station! *How is that again?* Yep, it's true: The differences between the best and worst receivers, and the differences between "below average" and "legal limit" transmitters, are not nearly as great as those found between excellent and poor antennas.

Let's take a minute to think about that. A world-class receiver, the most state-of-the-art available, probably has a sensitivity of about 0.1 µV (microvolts) for a readable signal on CW or SSB, if measured in a *closed system* (no antenna connected) on, say, 14 MHz. Problem is, noise sources are usually much stronger than that on 20 meters as soon as you connect any kind of worthwhile antenna. The connection of even a meager half-wave dipole will tend to raise the "noise floor" of a 20 meter receiver to something up around 0.35 µV, or by about 10 dB. Connecting a really *great* antenna might raise it more than that, literally masking all signals below that level. (The bigger the antenna is, and more gain it has, the more *noise*, as well as signals, it will receive.) Noise sources include such things as the sun, lightning storms, local electrical services and appliances, and radio signals which may or may not be in the band you're listening to. The presence of such noise will tend to pretty much allow an older-generation, second-rate receiver to *appear* to be about as sensitive as the latest state-of-the-art one on operating frequencies as low as our HF spectrum.

Then, let's look at the difference between an "average" 100 watt output transmitter and the big-boomer legal limit job. The difference between 100 watts and 1,500 watts is 1,400 watts—gotta be a big change, right? Not really. The power ratio here is 15:1, or expressed in decibels (dB), 11.76 dB. This number doesn't sound so big now, does it? 11.76 dB, rounded off to 12 dB, is exactly two "S" units of received signal strength, using the industry-standard "6 dB per S unit" scale.

But, what kind of differences can we expect from antennas? Well, using a half-wave dipole as a reference of 0 dB gain or loss, the average Novice ham antenna probably has about *-3 dB* gain. This is because most simple antennas are not as efficient as a half-wave dipole *installed in free space*, for a variety of reasons. The biggest variable is that most hams cannot install a dipole in free space, but tend to hang their antennas off convenient supports and elevate them less than they would a "free space" antenna. Technical experts will argue this point all day long, but let's assume for now that I'm right.

How effective is the average multiband vertical antenna, then? Most are not terribly good. The typical base-fed quarter-wave radiator vertical *could* be as efficient as a half-wave dipole *if* its ground losses could be reduced to *zero*, which is almost never the case. A quarter-wave, base-fed vertical relies heavily on the efficiency of its *image plane*, which is effectively the "other half" of the antenna (that is missing in a quarter-wave base-fed vertical). At VHF or UHF frequencies, this "image plane," or ground system, can be made highly efficient and be literally built into the antenna itself because the working dimensions are so small. This is the conventional "ground plane" antenna, with three or four (or more) resonant radials built right into the design. At HF, since the frequencies are so low and wavelengths so long, it is impractical to "build in" the image plane, counterpoise, ground radial system or whatever you choose to call it. (This system has various names depending on its theory of operation and who wrote the text describing it, but for our purposes, it's all the same thing: We're discussing the part of the antenna beneath the feed point of a base-fed vertical, which tends to serve as the "missing half" of the vertical dipole.)

Most quarter-wave verticals work terribly without an intricate, low-loss and resonant system of ground radials which help make up a nearly lossless image plane. These can take up a great deal of space, especially on 40-80-160 meters, where wavelengths are about as long as the band nomenclature describes. A full-size 80 meter radial resonant at 3.5 MHz will occupy 67,473 square feet of real estate, or about one-and-one-half acres of property! If you live on a large farm this may not be a problem, but for most of us it is.

What to do . . . what to do? Aha! How about making our vertical half-wave, instead of quarter-wave? This will raise the feed point impedance to something very high and make ground losses inconsequential. A half-wave, base-fed vertical really doesn't require any ground radials. Problem is, its feed point impedance will be too high to reasonably match our standard coaxial transmission lines, which are in the 50 to 75 ohm range. Aha again! What about building a matching network into the base of the antenna, to match its very high feed point impedance to 50 ohms, so we can feed with coax and still match up quite well?

This is exactly what many commercial manufacturers of HF verticals have done. Without mentioning products specifically, you'll see that many advertised verticals say they are "half-wave" and either don't require any ground system, or have some sort of radial system which is very small but effective (since ground losses are of almost no consequence in these designs, anyway) built right into the antenna. Great, huh?

Maybe yes, maybe no. Most of the commercial multiband verticals may appear to be half-wavelength *electrically*, but are far shorter physically and therefore not as efficient due to reduced *aperture* (the area of the antenna that crosses the electromagnetic waves), especially on the "lower" HF bands, like 40 and 80 meters. They also exhibit some loss in the matching network(s), especially if they are broadband networks intended to match to coax over a broad frequency range. Also, because the *real* (unmatched) feed point impedance will be very high, so will the RF voltage appearing at the base of these antennas, since E (voltage) = the square root of P (power in watts) times R (the radiation resistance, or impedance), so the higher "R" is, the higher the feed point voltage will be.

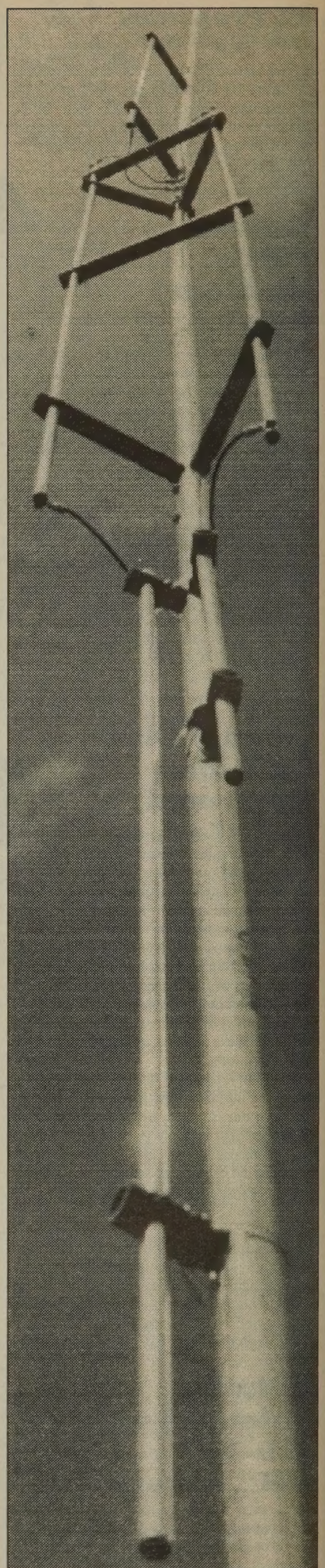


Photo A. Looking up from the base of the GAP Challenger vertical antenna.

For example, say your half-wave base-fed vertical appears to be 2,000 ohms at 14 MHz, and you feed it with 200 watts of power (assuming a lossless transmission line, and a lossless matching network at the base of the vertical). The E, or RF voltage at the base of the antenna will be the square root of 200 x 2000, or the square root of 400,000, which is 632.45 volts. Wow! That's a lot of voltage. At 1,500 watts, this voltage will be 1,732 volts! Ouch! This could be hazardous to touch, for sure, and could also possibly incite "corona," or ignition of gasses (like air) near the antenna base and tip (since in a half-wave antenna, the voltage will be essentially the same at the base and the top) and possibly even start a fire if nearby combustibles happen to ignite. (It's happened to me.)

Another problem is that most multiband HF antennas, especially verticals, contain "traps," or some sort of resonator system which decouples the RF current at specific points along the radiator to make the antenna appear the same electrical length on all bands. (In our example, this might be at the electrical half-wave point.) These "traps" are generally parallel *L-C networks* whose "Q," or selectivity, depend on the ratio of inductance to capacitance. A high Q network will be the most efficient, but will be very narrowband and limit the frequencies of operation. A low Q network won't be as efficient, but might allow operation over a wider portion of the band. No winning this one.

Ugh. You can see why multiband HF verticals don't enjoy a sterling reputation. They usually contain so many design compromises that they just cannot be efficient radiators across so many bands. Enter the GAP "Challenger" vertical!

The GAP Challenger

GAP Antenna Products, Inc. (Vero Beach, Florida) has a product on the market called the "Challenger DX-VIII," I guess implying that it works DX and covers eight bands. I own and recently installed the previous version of this antenna, called the Challenger DX-VI, which, as far as I can tell, is really the same antenna. The difference is that the DX-VIII is rated to cover 80-40-20-15-12-10-6-2 meters (8 bands) while the DX-VI did not include 6 and 2 meters in the ratings. However, the DX-VI does radiate on 6 and 2 meters, and indicates a low VSWR on these bands so, if there are any differences in the two antennas, they are probably very minor.

The difference between the GAP verticals and the others on the market is that the GAP is *big*, and is center-fed rather than base-fed. It appears as an electrical half-wave on all the HF bands (I have no idea how it works on VHF!), with its current lobe at the *center*, rather than the base, of the antenna. This elevates the feed point to 16 feet above ground, so for a ground-mounted installation your signal is emanating from a point far higher above the earth than with a conventional base-fed vertical. Also, its physical size makes it more efficient than shorter antennas would be because its aperture is larger.

The Challenger is 32 feet tall, about 10 feet taller than most similarly-rated multiband HF verticals. It contains no matching networks, baluns or traps. The Challenger requires its user to install only three relatively short (25') radials which, as far as I can tell, only perform a function on 40 and 80 meters and seem to have no effect whatever on the higher bands. Even with its three 25' long radials attached, this antenna occupies a scant 1,964 square feet of real estate, or about one-twentieth of an acre. It therefore could be installed on a very small lot and still be effective as long as it is spaced well away from other conductive (metallic) vertically-polarized objects.

Suggestions

1. The assembly/instruction manual provided by GAP is pretty good, but unfortunately omits details on positioning the "tuner rods" with respect to the main aluminum radiator sections. The only way to really figure it all out is to carefully study the sketch entitled, "Assembled GAP DX-VI Antenna" and make your antenna look exactly like the sketch when you're finished. It took me a few tries to get it all right, and I've built hundreds of antennas. Don't get frustrated—it *will* all go together properly, and if you reach your wits' end, the friendly folks at GAP will talk you through it on the telephone.

2. GAP lightly recommends using rope guy lines, not provided with the antenna, installed above its midpoint to help secure the antenna in heavy winds. I can tell you, I'd *strongly* recommend those rope guys as this thing is very tall and catches quite a bit of wind, even on days when the wind doesn't feel very strong. The guys *must* be non-conductive, and I'd recommend using Dacron rope, such as that offered by Synthetic Textiles of Ventura, California, to avoid stretching or damage from ultraviolet radiation.

3. Because the antenna is so tall and the weight is distributed over its entire length (the weight is *not* all down by the base—in fact, the heaviest part is the middle), I wouldn't install it on a roof unless this were really a last resort. And *then*, I'd use a *very* strong reinforced tripod to hold the bottom, and make sure the tripod is well attached to strong support members of the roof. And try to set the antenna back 25 feet from any edge of the roof, to allow room for those three radials.

4. When you ground-mount your GAP Challenger, definitely mount the "mount section" (a three-foot PVC tube) in a bit of cement poured into the hole which will hold the mount. I ended up digging an 8" diameter hole, about 30" deep, using a post-hole digger, and tapping the "mount section" into the floor of this hole (tap lightly to avoid damaging the top end of the PVC tube, which could prevent future antenna installation), then pouring in about 75 pounds of "Quikrete" fast-setting concrete to secure the "mount section." If you do this, and I'd recommend you do, be sure the "mount section" tube is absolutely vertical before, during, and after pouring the concrete, checking with a carpenter's level to be sure. If this mounting tube goes in just the slightest bit crooked your whole installation will be thwarted. You don't want 32 feet of vertical antenna installed at a tilt—it would make it mechanically weak and funny-looking, and it probably won't work as well.

5. When you install the antenna itself on the mounting tube, definitely get a friend (or two) to help. This thing is difficult to handle for one person, unless maybe you're an NBA All-Star center, or someone of similar size.

6. One nice thing about the GAP mounting is that when the antenna is "mounted," it literally just sits on the support tube and can be easily removed within seconds after disconnecting the guy ropes. And don't worry

about "losing" the "mount section" forever in a chunk of concrete in your backyard—the "mount section" is nothing special, just a three-foot piece of PVC tubing that could easily be procured at the local hardware store or, in a pinch, from GAP themselves. This is a nice feature for someone who wants to install the antenna but plans to move in the near future, or for someone who moves a lot. The entire installation; including digging the hole, mixing a bag of concrete, pouring it in, waiting a day or two for it to set, and installing the antenna; takes no time at all and would not be a chore to repeat several times a year if necessary.

How Does It Work?

Like crazy, that's how! Unlike most multiband HF antennas, there's absolutely no adjustment to make and nothing to "tune" on the GAP. Once it's installed, you just have to connect it to a piece of 50 ohm coaxial cable and get on the air. Although my antenna is installed more than 200 feet behind my house (so I needed almost 250 feet of coax feedline), I had it on the air in a matter of minutes after installation. When you order the "Challenger," they ask you what section of 80 meters you want it to cover, since that's the only band where it cannot cover the entire band with a low VSWR. I chose the "low end" (CW) portion myself, since I chase DX more on CW than on SSB, and sure enough, the antenna resonated at the low end. The only difference is the value of a high voltage capacitor that installs inside the top end of the antenna tubing (that's right, inside), and GAP ships the appropriate capacitor for the part of the band you select. This is not to say the antenna won't work elsewhere on 80 meters—it will, and pretty well—but the VSWR will be higher on the part of the band you *don't* select.

When I first fired up with the GAP, I called CQ on 20 meter CW and made my first QSO, with 4S7WP in Sri Lanka. Following that, I worked UAØQCA in Yakutsk, Russia, 9M2AX in Malaysia and ZS1OU in South Africa, all after one CQ. I *finally* made my first "local" contacts a few hours later, when I worked VE6AWI/M operating mobile in Edmonton, Alberta, and then W2HOA in New Jersey (on SSB). To say this antenna is effective would be a real understatement.

Prior to installing the GAP here at my new home (this is my first HF antenna here, having just moved in three weeks ago), I used it briefly for the 1992 ARRL Field Day operation from K6CAB/6 in Ventura County, California, last June. We had the GAP installed maybe 50 or 60 feet away from *another* multiband HF vertical on the same hilltop ridge, and had the feedlines from both antennas going to a coaxial switch on the 40 meter SSB rig. I had the opportunity to switch back and forth a few times between the two antennas and there was no comparison—signals were always stronger on the GAP, sometimes by S units, not just dB. Reports received from our transmissions confirmed the same results on transmit.

The only weak point I can mention about the GAP—if you'd even call it a weakness—is that its angle of radiation appears to be too low to effectively work the close in skip. As you know, HF ionospheric propagation requires that signals be reflected off ionized layers high above the earth, and the antenna's radiation angle will help determine the angle of that reflection. If your radiation angle is straight up (90 degrees), all your signal will be reflected back down towards you and the skip you can work will be very short, or close to you. If your radiation angle is very low, (0 degrees, right on the horizon), your signal will be reflected back to earth at the most distant point possible, and you probably won't work much short skip, because the farther DX signals will be much stronger than the locals. With the GAP, the radiation angle is quite low, making DX easy to work, but locals aren't quite as easy. This is a problem encountered with most verticals of good design and efficiency, and the only thing I can recommend to counteract this is to install a fairly low dipole (horizontal, or parallel to the earth) for any band where you want to work the short skip as well as the long-haul DX. A low dipole will have a much higher radiation angle than the GAP, and will help fill in the holes left by its low-angle radiation. But if DX is your goal, the GAP performs very admirably for a multiband, low-cost antenna that requires almost no property.

Did I mention the price? The GAP costs only $250 or so, making it one of the less expensive multiband verticals. I think it offers more "bang for the buck" than any antenna I've ever used for HF, and is so low-priced that home-brewing an equivalent antenna is almost senseless (aluminum tubing is expensive). If you like to build, experiment with supplemental dipoles to assist the GAP in achieving both short- and long-haul capabilities. RF

The GAP Challenger DX Series Antennas

The GAP Challenger DX-VI (and DX-VIII) antennas are rugged, well-made products that perform! They come in a UPS-shippable carton containing all parts necessary for assembly, including a hex-driver tool used for installing the stainless steel screws that hold the sections together.

Although GAP states that assembly requires about 45 minutes, I found it took about double that time, doing it myself. (A helper might have accelerated the process a bit.) The GAP antenna does *not* come with the three 25-foot radial wires, a hose clamp used to attach the recommended rope guy lines to the antenna, or the rope guys themselves. These items might cost an additional $5 to $10, depending on what materials you choose and how long your guy lines will need to be. For radials, I used two-conductor #14 "speaker wires," with both conductors tied at the antenna end of each radial, and crimped the conductors into 1/4" lugs for attachment to the mounting screws. GAP recommends that radials of *at least* this gauge be used (heavier might be better), and suggests using old coaxial cable for radials. For guy lines, I used 1/8" stranded nylon rope from a local hardware store, but this will probably only last six months or so in our strong sunshine before it starts to deteriorate. A better choice would be Dacron rope, which is UV-resistant and lasts a very long time in all sorts of weather. I'll change mine before long.

A tip on radial wire installation: *Don't bury the radials!* From my experience, buried radials don't work as well as above-ground ones, and obviously are more difficult to re-orient should that need occur. Lay the radials flat along the ground (grass, dirt, or whatever) and hold them in position with hammer-in tent stakes. This works well and allows you to move the radials around easily if you need to.

VSWR Analysis

I measured the VSWR, that all important parameter to hams (although it really shouldn't be), on all the GAP's rated bands of operation, plus a few bands it is *not* rated for, like 30 meters, 17 meters and 6 meters. The VSWR was measured using laboratory instruments, with the directional coupler installed right at the base of the antenna using only the GAP-supplied feedline section, which extends about one foot from the antenna base when it's assembled. This way, the SWR was not improved by the loss of my rather lengthy transmission line to the shack.

The 80 meter 2:1 SWR bandwidth was precisely what GAP said it should be: 160 kHz. But that doesn't make the antenna unusable elsewhere in the band, as it produced strong signals across the entire amateur band and the automatic antenna tuner in my TS-850S was able to match the system everywhere and produce full output. On 40, the GAP is a joy. Its SWR is below 1.7:1 across the entire band (unlike most multiband verticals) and it got out like gangbusters. Running a kilowatt output on SSB, I found myself working DX every night, and often winning in pileups. On 20 meters, the GAP performs admirably, although does not compete with the big guns using monoband yagis on tall towers. Its SWR ran from 1.75 to 2.1:1 across the band—a bit on the high side, but nothing to worry about—and it got good reports. On 15, the GAP matched very well across the band, never higher than 1.5:1 SWR, and again helped me receive competitive signal reports. On 12 meters, the SWR is good across the 100 kHz of band we are authorized to use, but I didn't work many stations as there was not much activity when I had time to operate. On 10 meters, the GAP truly covers the entire 1.7 MHz of band, with SWR running from 1.15 to 1.85:1 across the whole segment. I made many contacts on 10, as this is a very popular band, and received excellent to "outstanding" signal reports.

Although the Challenger is not rated to operate 30, 17 or 6 meters, I heard lots of signals on these bands so I decided to take VSWR measurements and make some contacts. On 30 meters, the SWR runs from about 2.2 to 2.65:1 across the band (not very encouraging), but when I used the antenna I was able to make lots of contacts while running 100W output from my TS-850S, whose internal automatic antenna tuner had no problem matching the system. Signals from the East Coast (2,500-3,000 miles away) were consistently strong beginning before sundown and continuing through the night. On 17 meters, the SWR is above 3:1 across the band, indicating a very severe mismatch, beyond the range of accuracy of my directional coupler, so I did not take point-specific data; however, the darned antenna refused to *not* make contacts so, using the internal tuner in the 850S, I loaded up and worked about a dozen stations all over North America and the Pacific using this antenna that definitely "won't work" on 18 MHz!

On 6 meters, the GAP is obviously going through one very strange impedance gyration, as the SWR curve looks like a bouncing ball and wanders all over the place, dipping at 50.2 and 50.8 MHz, and elsewhere up the band. But the SWR never exceeds 3:1, and the antenna really does work (to some extent) on 6 meters. I used it on FM, above 52 MHz, to make contacts through repeaters about 50-60 miles away, and also a few simplex QSOs. While I'm not overly impressed with the results, the GAP will work 6 in a pinch and might allow some hams to avoid putting up still *another* antenna for an occasionally-used band.

A Word Regarding SWR

This mathematical ratio of transmission line to load impedance is often not terribly important to operations and is a factor completely independent of antenna *efficiency*, surely a more important parameter. We often want to know what the SWR is for an antenna, as it can be a good indication of antenna resonance, connection problems, opens or shorts in our feedlines, and so forth. It can be handy to know that your 40 meter antenna has an SWR of 1.75 at 7100 kHz, and to keep that data on file for future reference. If, six months later, you find the same antenna's SWR as 3:1 at 7100 kHz, you'll know something has changed and you can investigate to find out what happened. (Sometimes, the change is something as simple as the antenna wire stretching and changing the resonant frequency of a dipole!) Or, on VHF, you might find your 222 MHz antenna's SWR mysteriously "improving" with age. In this case, it's probably the transmission line's fault: As coaxial cable ages and deteriorates from the effects of ultraviolet radiation and other factors, it often increases in *loss*, which will make your antenna's SWR appear "better," by the amount of cable loss. This is because the reflected power from the antenna is more attenuated as it travels back down the feedline towards your transmitter, so it will measure as "less reflected power" down in the shack, even though the antenna's SWR hasn't changed a bit! These are the kind of things to look out for when measuring SWR, and they are valid reasons for making the measurement and keeping the data handy.

Still, SWR is *not* related to antenna radiation efficiency, and two great examples come to mind: (1) The antenna I have with the best SWR is one I can't make a single contact with, because it's my well-shielded Bird "dummy load." It's SWR is perfect up to more than 1000 MHz, but it's so well shielded I can't work a thing with it! (2) I worked Australia, back when I lived in New Jersey, running 5 watts output to a half-wave end-fed wire without an antenna tuner (because I didn't have one at the time). This was on 20 meter CW, and the antenna wire was 35 feet long, just perfect to make it about a million-ohm load. I fed it with about 50 feet of coax, and the SWR was so high I couldn't detect any difference between "forward" and "reflected" meter indications in the shack. I heard a VK3 calling CQ, about S4, answered him, and completed a 10-minute QSO with this "impossible" antenna. A better indication of how an antenna works is "What does it hear?" If you hear plenty of stations, many of them will hear you, too.

Is Your Radio Club Sagging?

by Gordon E. Hopper W1MEG

Lately, a few articles about radio club activity have appeared in amateur radio magazines which left the impression that these activities are operating at a normal, or at least satisfactory, pace. This may be true in some places, but it does not apply to all parts of the country. For instance, some of the older radio clubs have gone out of existence, while others are barely clinging to life. Other clubs are attempting to rejuvenate themselves, lest the ax fall upon them.

What causes some of these clubs to falter? Some people will say, "Times have changed, today's ham is different than his older counterpart," or "A radio club no longer serves any useful purpose." Regardless of what the *actual* reasons may be, is it in our collective best interest to watch radio clubs decline while the number of amateurs remains about the same? No!

Many radio clubs today exist in name only. They neither provide technical assistance nor the group activities that were prevalent only a few years ago. Field Day operations provide the only activity in some clubs, while the number of participants even in this has decreased.

It is true that times have changed, but amateur radio is still amateur radio. Would it make more sense to ask if technology (rather than society) has brought about the decline of radio clubs? Is building our own equipment an obsolete idea? State-of-the-art advancements, complexities and complications are inherent in today's electronic equipment, but is that a good reason to watch the home-brewer go the way of the slide-rule?

Many amateur radio clubs today have a different breed of ham in comparison to those of 20 years ago. Today's young ham operators have many more distractions. Cable TV, video games, and new social freedoms are grabbing more time away from the young person of the 1990s. A faster pace of living, and the necessity for even teenagers to find jobs to maintain this pace, are other major considerations today. With all these activities, is it any wonder that so many hams prefer to purchase commercial equipment rather than build their own?

Bosh! We still need active people, held together by a common interest, to keep up the amateur spirit. Clubs can still teach radio theory and Morse code. Members can still provide communication for civic affairs, parades, road races, disaster or emergency services, Halloween patrols, traffic assistance, message handling, Civil Defense work, and many other services.

Many club officers fail to recognize that when a member needs some technical assistance and fails to get it, that can create a downward spiral. With no one to provide the younger generation with training, fewer technically competant members will be groomed for the future. And without easy access to equipment repair and maintenance, apathy too often takes over.

How can radio clubs hope to achieve success today when so many obstacles loom in front of them? A radio club whose members are predominately youngsters, where the older hams have dropped away from the club activities, should embark on an education plan. Where none of the older members are active, and the newer members have no conception of club activities other than to gather occasionally and rag-chew, what can be achieved? Although some members will participate in Field Day activities, a solid plan of attack must be formulated and implemented.

In an effort to help rejuvenate a sagging club, some of the following points could make the difference between a successful club, an unsatisfactory club, or no club at all:

Set up a so-called steering committee to initiate programs and stimulate membership interest. After a period of time, when newer members are appointed to this committee, there will always be an experienced member on the committee with them.

"How can radio clubs hope to achieve success today when so many obstacles loom in front of them? A radio club whose members are predominately youngsters, where the older hams have dropped away from the club activities, should embark on an education plan."

If the steering committee knows where the members' interests lie, they can set up a program schedule that will cater to these interests. If they don't know, then club membership should be surveyed to spotlight their various interests.

If membership numbers are declining, the committee can compile a list of local hams from the *Callbook*. A letter describing the aims, goals, and projected program schedules can then be mailed to area hams, soliciting their membership.

Several ways of promoting attendance at club meetings are: social notices or a series of continuing articles in local newspapers, broadcasts by local radio stations, or club bulletins.

Another way of providing more interest, both in money and action, is to have some form of a concession at all club meetings. Selling coffee and donuts provides one form of social activity. Enough profit can be made from the sale of coffee and donuts to buy a new Field Day tent each year, even in a 20-member club.

More Interesting Meetings

If a club is sagging, consider the number of meetings being held. Some clubs hold meetings biweekly. At this rate, it is impossible to provide sufficient program material slanted towards the interests of the majority of members. Reduce the number of meetings and review the types of programs presented.

Many electronics plants are more than happy to provide public speakers free of charge. You might even have club members with contacts at work to haul in a guest speaker. Perhaps there is a military unit in your area which could provide an interesting speaker for your club. Even the National Guard has some kind of radio installation. Retired military personnel who were associated with radio during World War II or later skirmishes should be able to make an interesting program. In larger towns and cities, the telephone company will often be glad to provide a speaker for your meeting. They also have plenty of movies available to lend. Is there an electric generating plant in your area? Planned tours of installations of this type often prove interesting. Tours through radio and TV facilities can provide an evening's entertainment. Some Federal Aviation Agency installations provide tours of their facilities including area control centers and large airport control towers.

Some smaller electronics factories allow tours through their plants. It does not take a giant company producing multimillion-dollar equipment for the government to be educational or interesting—it can be a small company producing diodes, potentiometers, small components, computers, or computer modules. Approach a local Army, Navy, or Air Force Military Affiliate Radio System (MARS) member. Probably he would be glad to provide an evening's program, which could result in either a talk or demonstration on teletype, facsimile, or surplus equipment conversions.

Many things can be accomplished within a club to maintain member interest. Programs to train or upgrade licenses can be initiated. Television interference (TVI) committees can assist in helping solve local TVI problems. An activities officer can set up varied projects or competitions. Examples of this are unlimited, but here are a few possibilities:

1. Set up a code competition program. Those interested can copy the CW practice run from W1AW on a specified night. The papers can then be checked by a proficient operator. A club certificate, (available from the American Radio Relay League) can be issued by the club to those who qualified. Members should be encouraged to copy the official CW proficiency runs transmitted by W1AW to acquire other certificates.

2. Set up a regularly scheduled operating club net. Some clubs provide a certificate to anyone who successfully contacts 10 other members. Many other club certificates are available throughout the world. A club net alone can keep many members active. Some nets have a speaker who occasionally talks to an entire net. This maintains interest. The various branches of MARS have technical nets in their schedule of operation.

3. Set up a construction program and build something by having a group working together. Magazines like this one and *73 Amateur Radio Today* are full of ideas. Some clubs build transceivers; others construct small items such as SWR bridges. When it comes to home-brewing electronic gadgets, the sky's the limit.

4. Encourage members to participate in contests. There are plenty of contests out there, many are quite competitive.

5. Conduct hidden transmitter foxhunts.

6. Conduct at least one club auction every year.

7. Arrange a competitive method for conducting DX contests and obtaining various available certificates. Establish a club ham-of-the-year award.

8. Promote local area hamfests. If your club is small, unite with a group of other small clubs. This effort can promote a successful hamfest. This is shown by the area around Boston, Massachusetts, where some clubs have banded together for several years. They promote very successful annual hamfests. This is a possibility worth exploring.

9. Field Day activities must be tightly planned. The more you organize in advance, the more satisfactory the results. Much can be written about accomplishing a successful Field Day, but the most important thing is to plan it in advance, rather than at the last minute. Select a chairman for this event. He should set up committees to handle most of the details. Draw up a set of rules or regulations. List all necessary equipment. Make provisions for group feeding: Either obtain a caterer or assess the group and give the money to a food committee. While some participants bring their own lunches, a group feeding supplies a sociable atmosphere to the outing.

10. A club banquet, combined with the installation of new officers, provides a social evening. (Presenting the retiring president with a gift is highly recommended; it motivates new officers.)

11. A club bulletin keeps up the interest of many club members. A committee can write, publish, and distribute one on a monthly basis. Even a one-page bulletin, regularly received, maintains interest; no bulletin (or one spasmodically issued) just won't cut it. A club newsletter can consist of meeting notices, forthcoming programs, technical information, notes pertaining to individual accomplishments, and general items.

When finances for a meeting place present a problem, request aid from local civic groups who already have a facility; a local manufacturer, churches, school assembly rooms or, in some areas, Grange halls, may be available. Large food chain stores sometimes provide free use of a community room on their property.

To summarize, if your club is faltering, explore the use or adaptation of some of the ideas described. If your members have little knowledge about keeping up the activity of a radio club, many of the ideas presented here can help. Try and select active amateurs to improve or guide your club. When this is accomplished, your club should flourish. RF

CIRCLE 92 ON READER SERVICE CARD

Two Simple Antennas

by Stephen W. Gibson WB4NBI

There are not many elements in the average amateur station over which you have as much control as the final one—the antenna. This is the component that launches your carefully generated signal into the air. Depending upon the design and location, the signal is either sprayed fairly indiscriminately in nearly all directions, or it is aimed in a rather narrow beam to some carefully selected location.

There are some amateurs who are lucky. They have a number of available trees on their property, spaced the right distance apart. With this arrangement they can spread a web of antennas of various configurations. There are a few amateurs who have fire watch towers on their property to which beam antennas can be attached with a minimum of difficulty. Or, if they're interested in the lower frequencies, they can put up "slopers" with no problem.

Then there are those of us living in such quarters as town houses, apartments or condominiums, where outside antennas, at least ones visible to the neighbors, are not permitted.

Adapt a Design

The care and feeding of the antenna is one area in which the average ham can experiment with a minimum of expense. There are any number of sources of information that he/she can turn to for help and guidance.

I fall into the category of those who are happy to accept the results of a design that has been documented by others, or to adapt the design to fit my particular set of conditions without going into the details of how and why the design works. This article will show you two successful designs that have worked for me and my 5 watts of QRP power.

My present QTH is a town house in a community typical of those previously mentioned—no outside antennas. (The local TV cable company does a big business!) Coming to this location from a house located on two acres of land, I was not very optimistic about achieving DXCC.

Memories began to come back of hams who had loaded up such "antennas" as bedsprings, window screens and guttering systems, but these expedients did not appeal to me. Then I read of a British ham who had success with a horizontal loop design installed inside the house, and so I adapted this design to the existing situation.

Construction

My operating position is on the second floor of the house in a 13' x 13' bedroom/study/shack. At each corner of the room I put in a 10 lb. picture hanger. These go into dry wall with little effort and leave easily-patched holes when removed. All hardware stores seem to carry them. Since they go in at an angle they do not pull out easily when the strain is downward as it is when supporting the antenna.

For the antenna I used some 24-gauge Radio Shack speaker wire left over from installing my stereo. Since 15 meters was hot at the time, I decided on a full-wave—44'6"—hung from the picture hangers with ordinary string. It was fed at one corner with RG 58 coax from a Heathkit tuner left from my romance with Benton Harbor. A scrap of plastic was used as the insulator at the corner, and the two ends of the loop were attached to the coax with #8 machine screws.

With this antenna and tuner combination I was able to get the SWR to under 1.5:1 on all bands from 10 to 40, and I made contacts to Europe and the West Coast without too much of a hassle.

However, thoughts of what the RF had to go through before escaping from the shack began to creep into my evaluation of the situation. I tried running some 26-gauge wire out the window to the nearest tree but an overnight snowfall clung to the wire and outlined its location to all of the early morning walkers.

Then I saw a description of what looked like a possible improvement to my situation. In a collection of antenna designs published by the English QRP group, G-QRP, there was one titled "The 4 Band Up-and Outer" by a Yank, C.F. Rockey W9SCH. It looked as though this could be placed close to the house wall and not be so noticeable. In addition, the vertical orientation would probably give the better low angle radiation advised for DX work.

You can see from Figure 1 that the design is very simple. There is a 16' vertical element and a 12' horizontal one, and the antenna can be fed with 300 ohm open wire feeder or 300 ohm twin-lead.

In my location, the top of the vertical element is fastened with string again to a screw eye put into the eave overhang outside the shack window. The bottom of this element comes within 6" of the porch floor on the first floor level and is attached to another screw eye in the floor. The horizontal element is stretched out and tied off to the nearby porch railing. Since both elements are close to the house wall they do not interfere with the use of the porch.

A scrap piece of Plexiglas is used to connect the antenna elements with the lead in as in the loop using #8 machine screws. In my installation I used some 300 ohm twin-lead that I had in the junk box and connected it to the same tuner as described previously.

Does it work? My very first contact right after finishing the installation was out to the West Coast from here in Virginia.

QRP Organizations

QRPers seem to do more home-brewing and experimenting, or at least they publish more. This aspect of the hobby goes back to the beginning of it all when nearly everything was handmade and wired together. If this sort of thing appeals to you, you might consider joining one or more of the organizations devoted to QRP operating and get their publications.

The *QRP Quarterly* is published by the QRP Amateur Radio Club International, and sending $2 to Mike Kilgore KG5F, 2046 Ash Hill Road, Carrollton TX 75007 will get you a sample copy and membership information.

The English "G-QRP" publication, *SPRAT*, seems to also cover all aspects of the hobby, with contributions from amateurs worldwide. Subscription and membership information can be obtained from Luke Dodds W5HKA, 2852 Oak Forest, Grapevine TX 76051.

Both of these organizations are worth their $12 annual membership fees, and I think that you will find the publications make interesting reading. Good luck! RF

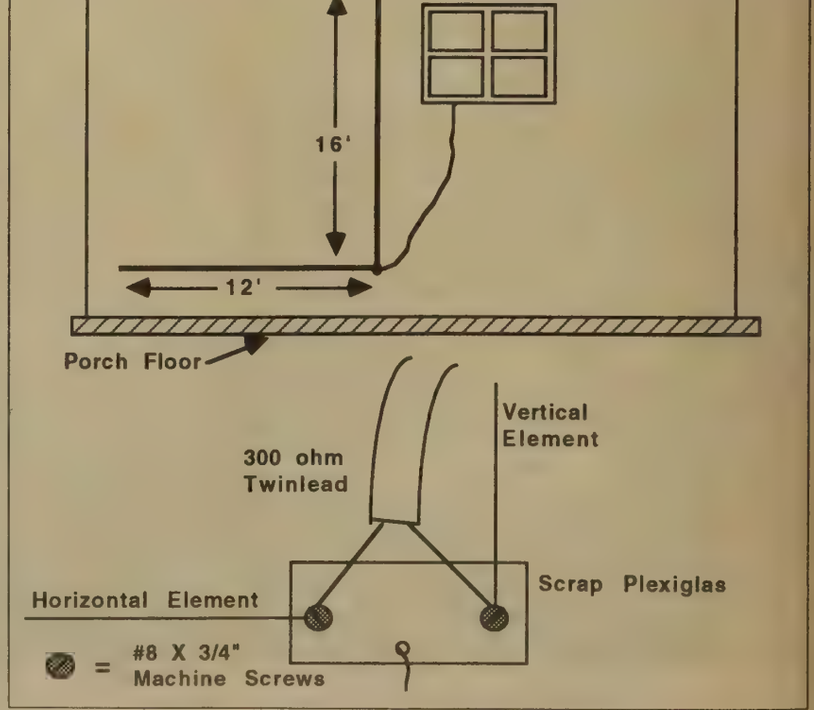


Figure 1. Design for a simple QRP antenna.

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Construction

My operating position is on the second floor of the house in a 13' x 13' bedroom/study/shack. At each corner of the room I put in a 10 lb. picture hanger. These go into dry wall with little effort and leave easily-patched holes when removed. All hardware stores seem to carry them. Since they go in at an angle they do not pull out easily when the strain is downward as it is when supporting the antenna.

For the antenna I used some 24-gauge Radio Shack speaker wire left over from installing my stereo. Since 15 meters was hot at the time, I decided on a full-wave—44'6"—hung from the picture hangers with ordinary string. It was fed at one corner with RG 58 coax from a Heathkit tuner left from my romance with Benton Harbor. A scrap of plastic was used as the insulator at the corner, and the two ends of the loop were attached to the coax with #8 machine screws.

With this antenna and tuner combination I was able to get the SWR to under 1.5:1 on all bands from 10 to 40, and I made contacts to Europe and the West Coast without too much of a hassle.

However, thoughts of what the RF had to go through before escaping from the shack began to creep into my evaluation of the situation. I tried running some 26-gauge wire out the window to the nearest tree but an overnight snowfall clung to the wire and outlined its location to all of the early morning walkers.

Then I saw a description of what looked like a possible improvement to my situation. In a collection of antenna designs published by the English QRP group, G-QRP, there was one titled "The 4 Band Up-and Outer" by a Yank, C.F. Rockey W9SCH. It looked as though this could be placed close to the house wall and not be so noticeable. In addition, the vertical orientation would probably give the better low angle radiation advised for DX work.

You can see from Figure 1 that the design is very simple. There is a 16' vertical element and a 12' horizontal one, and the antenna can be fed with 300 ohm open wire feeder or 300 ohm twin-lead.

In my location, the top of the vertical element is fastened with string again to a screw eye put into the eave overhang outside the shack window. The bottom of this element comes within 6" of the porch floor on the first floor level and is attached to another screw eye in the floor. The horizontal element is stretched out and tied off to the nearby porch railing. Since both elements are close to the house wall they do not interfere with the use of the porch.

A scrap piece of Plexiglas is used to connect the antenna elements with the lead in as in the loop using #8 machine screws. In my installation I used some 300 ohm twin-lead that I had in the junk box and connected it to the same tuner as described previously.

Does it work? My very first contact right after finishing the installation was out to the West Coast from here in Virginia.

QRP Organizations

QRPers seem to do more home-brewing and experimenting, or at least they publish more. This aspect of the hobby goes back to the beginning of it all when nearly everything was handmade and wired together. If this sort of thing appeals to you, you might consider joining one or more of the organizations devoted to QRP operating and get their publications.

The *QRP Quarterly* is published by the QRP Amateur Radio Club International, and sending $2 to Mike Kilgore KG5F, 2046 Ash Hill Road, Carrollton TX 75007 will get you a sample copy and membership information.

The English "G-QRP" publication, *SPRAT*, seems to also cover all aspects of the hobby, with contributions from amateurs worldwide. Subscription and membership information can be obtained from Luke Dodds W5HKA, 2852 Oak Forest, Grapevine TX 76051.

Both of these organizations are worth their $12 annual membership fees, and I think that you will find the publications make interesting reading. Good luck! RF

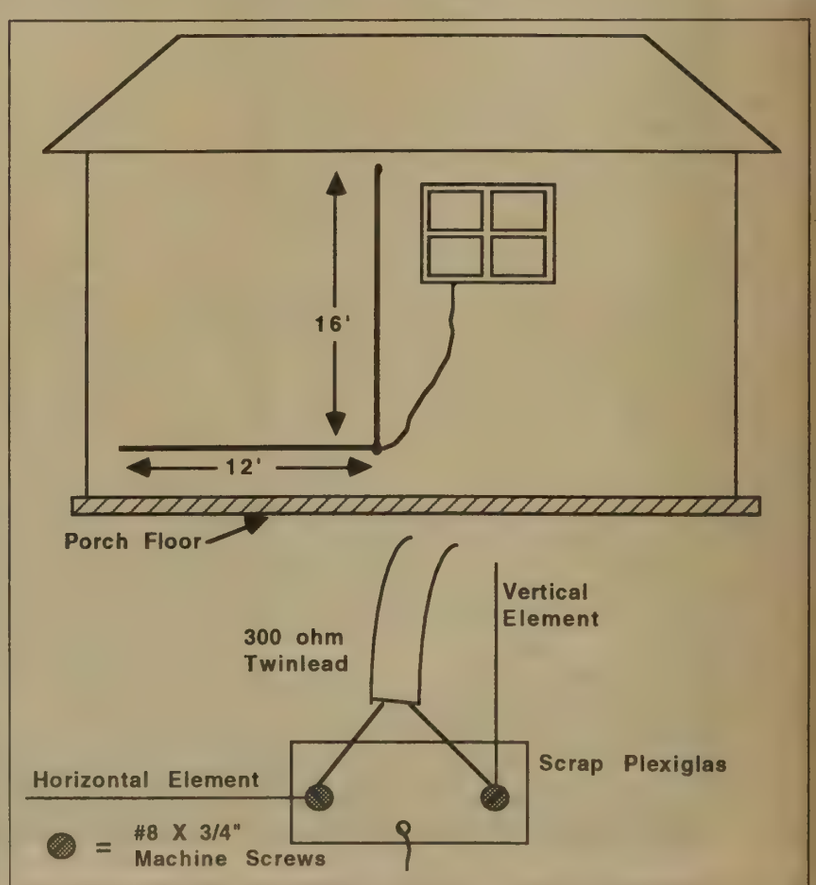

Figure 1. Design for a simple QRP antenna.

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advertiser index

RF user's report

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793 Canning Parkway
Victor NY 14564
Telephone: (716) 924-4560
Price: Kit, $149.95; case, $24.95;
S&H (USA) $3.95.

Building the Ramsey FX-223 Transceiver

by John Cunningham AA4AW

Decades ago hams prided themselves on building their own equipment—whether it was from a kit or from parts in the junk box. Most builders believed that their product was better, or at least cheaper, than factory-assembled radios. There are still kits available today that are less expensive than pre-assembled equipment and that help the user learn construction and electronics as he builds.

The Ramsey Kit

Ramsey Electronics is answering this challenge. It produces numerous kits, including transceivers. The cost of the FX-223 transceiver (the 222-225 MHz rig which I assembled)—including the case but not including the microphone, speaker, and power supply—is about $180.

Ramsey was prompt about sending the kit; I had it eight days after I ordered it. I didn't find any parts missing, or any defective components. I also found Ramsey's instructions to be straightforward, with two checkboxes beside each set of instructions. Ramsey's claim that the kit can be put together in two evenings by a fast kit builder probably is accurate.

Assembly Was Easy

There was only one mistake I found in the instructions. After assembling the stage F circuit, Ramsey tells you that to test the circuit you need to temporarily install a jumper wire to get the proper voltage to the circuit being tested. The word "temporarily" is the only hint you get that the jumper will be removed eventually. Several pages later, when testing circuit H, they say, "We assume. . . a jumper wire is still in place." Several steps later when the kit is almost complete, Ramsey calls for you to make another test. This time the kit will not work unless the jumper is removed. Since there were no instructions to remove the wire, it was only at a guess that I did so. The circuit worked after the jumper was removed.

Getting Organized

Ramsey groups most of the parts for you. All of the 0.01 µF capacitors were on one ribbon and all the 0.1 µF were on another. The same was true for most of the resistors. All of the transistors were in one plastic zip-lock bag, and all of the integrated circuits were in another. With that much organization already done for you, the parts were easier to find. The organization of parts was not *all* done by Ramsey; there was still room for the use of egg cartons or the corrugations in cardboard boxes to organize the other parts.

With Ramsey kits you assemble a system and then test that system as you go—none of this business of assembling the entire kit before you test any of it! The first thing Ramsey asks you to assemble is the power supply. There are three voltages: 12, 5, and 8 volts. The voltage sources are essential for the rest of the rig to work, so it is logical to start here. Assembling the first steps, then testing the system and finding that it works, gives the builder confidence to proceed. If for some reason the voltages are not right, the problem can be found easily since there are few components on the board at this point.

Ramsey warns you that its circuit card was not meant to have parts put on and taken off later. However, the idea that you will never have to remove a component once it is installed is an ideal that cannot always be achieved—especially if you want to modify the kit later. After all, that's why many of us build kits in the first place.

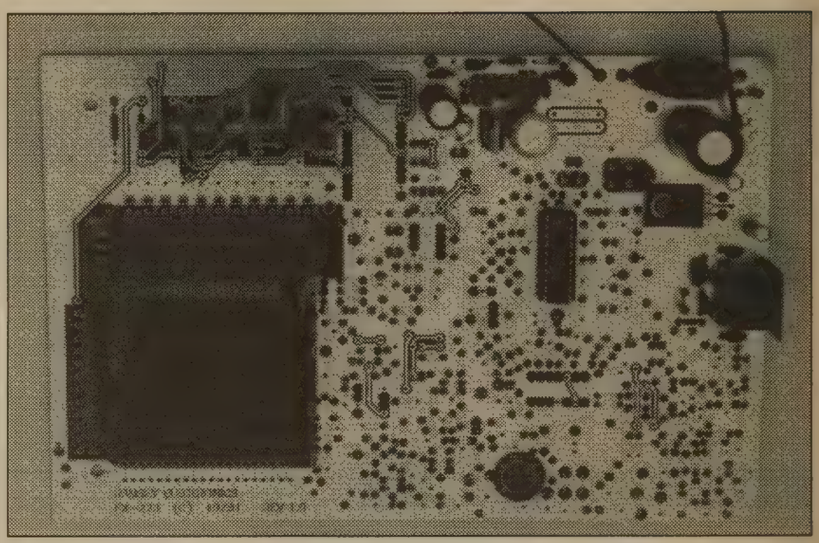


Photo A. The FX-223 in early stages of assembly.

The old Heathkit company provided component layouts that showed what the voltages should be on the transistors on their circuit cards. In addition, it often had charts that gave voltages at critical locations, as well as oscilloscope patterns. These diagrams are great troubleshooting aids, and they are sorely missed in the Ramsey kits. It would not take a lot of effort for Ramsey to include these.

Will Kit Building Make a Comeback?

In today's factories, robots are doing a lot of the equipment assembly. These automated machines are faster and more accurate than humans, and they make the cost of the rig lower than it would be otherwise. Kits may never be as sophisticated as factory-built rigs, but if you want simplicity and have a desire to learn, turn to a kit.

As I stated earlier, the FX-223 is not a full-featured transceiver like the kind we're used to. The feature I miss the most is a digital readout. Another is autopatch capability (though wiring in a simple Touch-Tone pad, or a microphone with the pad built in, would be fairly easy to do). Still another is that the FX-223 is initially limited to only 12 channels. Can these missing features be put in later? You bet! Ramsey has kits that will add many of these features and others can be home-brewed with just a little ingenuity.

One thing you cannot duplicate if you add these features is compactness. A Ramsey-assembled kit with a digital readout, a tone encoder, and more than 12 frequencies will be bulkier than a commercially-built rig with the same features.

Some features would be harder to build into a Ramsey kit. One of these is programmed memory, and another is scanning ability. The March 1993 issue of *73 Amateur Radio Today* had an article that told how a similar Ramsey kit (the 2 meter version of the FX-223) could be hooked up to a computer and all of these features incorporated ("Computer Control for the Ramsey FTR-146" by Richard E. Lucka WD8BNR, p. 60. Also see "Updates" April 1993 p. 39, June 1993 p. 59, and August 1993 page number TBA). A split voltage-controlled oscillator, which would allow transmitting and receiving simultaneously, is also possible with this kit.

The prices of new amateur equipment keeps going up, and rigs get more complicated. At some point, transceivers simply become too expensive and too complicated for the average ham.

The time may come when ham rigs will consist of largely standardized circuit cards. A ham will decide what kind of rig he wants, what features he wants the rig to have, and order the cards for such a rig. He could then assemble the rig from the cards and make changes as often as he wants.

My thanks to the XYL, Carolyn KC4NBE, who assisted with the project.

Photo B. The assembled rig, mounted and working.

radio magic

by Michael Bryce WB8VGE

By now you should have a working DIY keyer on your table ("Radio Magic," May and June 1993). But, if you're not so lucky, we'll go over the project and troubleshoot the logic this month.

But before we break out the VOM, let's look at the PC board for misplaced components and diodes. I've emphasized proper component placement over and over as we built the project, but it's very easy to goof. Installing a diode backwards will really screw things up.

Be sure you have all the banded ends of the diodes soldered to the PC board, with the bands pointing in the correct direction. How about the 10 mF capacitor? You don't have it installed backwards, do you? The transistor should have the flat side of its case pointing toward the wires going to the battery and paddle.

Check to see if both of the ICs have their #1 pin in the proper location on the PC board. Check the PC board overlay for their proper placement. In both cases, pin #1 should be pointing in the same direction. In other words, if you have pin #1 of the 4011 going one way and pin #1 of the 4027 pointing the other way, you've got something amuck. Pin #1 is located by the dot or a small #1 on the chip. Sometimes you'll see a notch on one end of the chip. Looking down from the top of the chip, with the notch to the top, pin 1 is to the left of the notch.

Check for the proper location of the remaining components. Since you don't need to worry about polarity with the resistors and disk capacitors, simply check their location on the PC board. Pinpointing misplaced resistors can be tricky. Check for proper placement by using the color code bands on the resistors against the PC board overlay. If you don't know all of the resistor color codes by heart, then use a resistor color wheel to speed things up. You used to be able to get these at Radio Shack. Mouser Electronics sells them for only a couple of bucks. Why not seize this opportunity to learn the resistor color code?

If you find that all the components are mounted correctly to the PC board, then the remaining problem to look for is SOLDERING! Just ask anyone who has ever repaired electronic kits for a living. Nearly 90 percent of the problems with non-working kits can be traced to bad soldering. I can't tell you how to fix your keyer if you have it soldered incorrectly. Remember, use just enough solder to complete the joint without cooking the component.

Look at the foil side of the PC board. Do you notice any large globs of solder on the pads? How about a joint looking gritty, like sand? How about two or more pads connected together causing a solder bridge? Any of these things could prevent your keyer from working.

If you suspect a bad solder joint, heat up your soldering iron. Now, take the board in one hand and raise it in the air above your worktable and touch the suspect joint with the iron. Gravity will pull the molten solder down to the soldering iron's tip. *Watch out for molten solder dripping!* Resolder the joint using new solder and allow it to cool. Do this to all suspect soldering joints.

Have someone else look over your work. Your spouse or a friend can help here. You don't need to know advanced AC theory to spot a glob of solder where it just doesn't look right. By the way, here's a handy indicator of possible soldering problems: Did you use two pounds of solder to assemble the keyer? You should have only needed about one to two feet of solder for the keyer.

So, you've checked and checked and checked some more, and it still won't work. Now what do you do? Well, in the past I've mentioned taking voltage checks. Let's put those theories to use troubleshooting the keyer.

"So, you've checked and checked and checked some more, and it still won't work. Now what do you do?"

One of the first things we need to find out is what the keyer is doing or not doing. It's not as silly as it may sound. You can have a keyer produce only dots, no dashes, and so forth.

If the keyer is dead and won't do a thing but sit there, then you're in luck as this is the easiest symptom to fix. Will the keyer only make dots? Only dashes? Won't key the rig? Keys the rig all the time? Sometimes a problem with one area will affect a different circuit and throw you off course. Let's dig in.

Break out your VOM and set it up to read DC voltage and connect the negative lead to the large ground foil on the keyer's PC board. You can also connect this lead to the negative side of the battery clip. Either one will work, as they are connected together.

First things first. Did you use a fresh battery for the keyer? You didn't steal one from the smoke detector, did you?

Use your fingertip to feel the tops of both ICs. They should not be even the slightest bit warm, especially being powered by a 9 volt battery. Any smoke? Better not be; as we all know, electronics runs on smoke. Yup! If you let the smoke out, the parts will no longer work.

Next, check the battery voltage. It should be around 9 volts. If you find the voltage to be very low, even with a brand-new battery, remove the battery from the keyer and let the battery stabilize a bit. Check the battery voltage again. If the battery voltage bounces back to 9 volts then you have a short circuit between the battery and the PC board. You may also have a shorted IC. It's rare, but it does happen.

Reconnect the battery to the keyer if you have not done so already. Using the VOM, check for +9 volts at pin 14 of the 4011 and pin 16 of the 4027. Is it there? If not, you've got an error in your wiring or a missed solder joint. If you have the proper voltage, check the base of the 2N2222 transistor. You should see zero volts there.

Check for voltage on pins 7 and 8 of the 4011 and 4027 respectively. They must be zero volts as these are the ground pins. If you see any voltage on either pin, you have a problem and it's going to be a solder bridge or a broken PC trace. You might also have a pin not seated in the IC socket.

If the battery voltage seems to be fine, we need to find out if the keyer's clock is running. Lucky for us, this clock is easy to observe. You can use an analog VOM or a logic probe. You can get a logic probe at Radio Shack for about $20. It's well worth the money and it will make a great addition to the workbench. A logic probe does exactly what the name implies: It checks the state of an IC gate and displays the results for you to see, usually on a LED in the probe's handle. Since the gate must be either on (a logic 1) or off (a logic 0) we can see what is going on at each gate.

You can use an analog VOM to see the logic switch, too, provided the logic signal we're trying to monitor is not going too fast. If the logic signal is above about 2 kHz the meter's needle can't respond fast enough. That's when you need the logic probe or, better yet, an oscilloscope.

Connect the logic probe or analog VOM to the output of the clock gate. That's pin #10 of the 4011. You should see the logic probe's LED flash back and forth as the output changes state. By running the speed control through its range you should be able to see the clock either speed up or slow down. If you see nothing, then check R2, R1, C1 and the connections to the speed control. You may also have a bad 4011. The only way to tell is to swap out the chip with a known good chip. Remember: no clock, no logic, no work.

If the clock is running, check for operation at pin #1 of the 4027. Press the dot key paddle and watch the output from pin 1. You should see it change states as it flip/flops back and forth. If you have the clock going in, but nothing coming out, check D1, D3, D2 and the connection to the key paddles. You may have a bad 4027 too. Swap it out with a good one and retest.

Next, check pin #15 of the 4027 for the same thing, only this time press the dash paddle. Again, you should observe the logic changing as the 4027 processes the clock's pulses. If there is a problem here, look at D2, D3, D4 and, of course, the paddle connections.

If either half of the 4027 is not working because of bad parts or the chip, the keyer should produce only dots if FF2 is not working, or only dashes if FF1 or the parts connecting to it are bad. At this point, the logic switching is so slow that you may want to use your analog VOM to follow the logic through the remainder of the circuit.

Now, if you can see the logic change states on both pin 1 and pin 15 of the 4027, we have to check to be sure they go to the last gate of the 4011. Close the dot paddle. Using the probe, check for switching logic at pin #12 of the 4011. Got it there? Good. If not, you have a broken PC trace or unsoldered pin on the socket or an IC pin may have been bent under the socket and is not fully seated in the IC socket. Close the dash paddle. Check for the same logic on pin #13 of the 4011.

Having both dot and dash logic at the input to G4 of the 4011, then we must have the proper output at the gate's output pin #11. Again, use your probe, or VOM, and check for operation while closing first the dot and then the dash paddle. You should see the logic go from low to high following the code. Move your probe to the base of the 2N2222 and again close either paddle. The base voltage should increase to 0.7 volt and turn on the keying transistor, keying the rig.

Having followed the logic all the way to the switching transistor and you still can't get it to key your rig. You're down to three choices: Either the transistor is bad or the wiring between the keyer and your rig is bad. The last choice is a rare condition. It's possible the 2N2222 won't key your rig and you'll need to rework the keying scheme. Next month we'll look at some different keying methods.

Short out the wires going to your rig from the keyer. I assume you have the rig on. This should key the rig. So, this tells us the wiring is fine. Check the plugs and jacks again. Then, when all else fails, remove the 2N2222 and install a new on. Retry the circuit and it should work. If not, check around the base of the transistor. A keyed-down transmitter may be caused by either a shorted 2N2222 or a glob of solder between the collector and the ground leads of the transistor. Be sure you check this area over closely.

That should do it! As Sherlock Homes would say, "After you remove the impossible, whatever is left, however improbable must be the truth."

Did you enjoy this project? Would you like to see more simple-to-build projects here in "Radio Magic"? Of course, we won't be going into as great detail as we did with the DIY keyer, but we'll do more projects if you're interested. Let me know. Let the editors know.

Next month, we'll heat up the soldering iron again and do some quick modifications to the circuit. RF

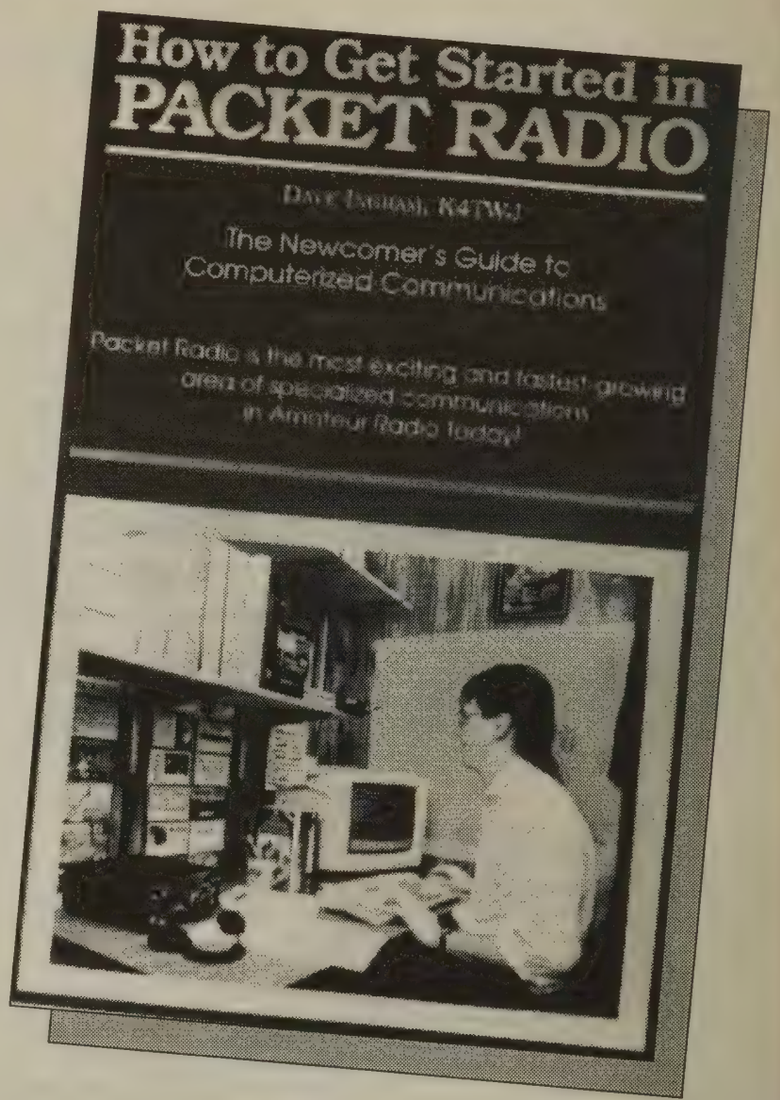
RF book review

National Amateur Radio Association
P.O. Box 598
Redmond WA 98073-0598
Price: $9.95

How to Get Started in Packet Radio

by Dave Ingram K4TWJ

reviewed by Morgan Godwin W4WFL



When the postman recently deposited a copy of *How to Get Started in Packet Radio*, by Dave Ingram K4TWJ, with my concierge, I had been struggling to get a multimode data controller up and running and had just about written off the entire project. Putting my problems aside, I picked up the book and settled down to learn about that alien and most frustrating mode, packet radio. A few hours later I had resolved to see things through and was determined to get the beast to jump through the hoop on command.

Writing in an easy "can-do" conversational style, the author begins with a simple and non-technical introduction to packet radio. His explanation of digipeating, with its analogy to students passing notes in school, is technically accurate and easy for newcomers, including this writer, to understand. Following a brief history of packet radio and its current capabilities, he explains what it takes to get started in packet. Home computers, dumb terminals, TNCs, multimode controllers, software parameters, transceiver considerations and antenna systems are all covered in terms that are easily understood by the Novice.

A comprehensive survey of available packet equipment and compatible transceivers and antennas guides the prospective packeteer through the process of choosing what he'll need to get on the air. There is also a valuable chapter on setting up your station. It provides helpful suggestions on such practical matters as what you'll need in the way of cables to interconnect the various bits and pieces, how to choose a location for the station, and how to deal with TVI and RFI.

Assuming that the reader has now put together his packet station, Ingram leads him through the process of setting the various command parameters between the computer and the TNC, reviews often-used commands, and explains how to set transmit and receive levels and how to perform a self-connect to ensure that everything is operating properly. Even those cryptic commands that are required to operate a packet station are covered in a manner that enabled me to understand (I think) what they're all about.

A section dealing with making your first packet contact provides useful pointers for making a direct or digipeater connection and for any final tweaking that might be necessary to make certain everything is working as it should. Tips on how to be a good packet operator are also included.

After getting you on the air and through your first packet contact, Ingram explains BBSs, NET/ROMs, ROSEs, backbones, trunks, gateways and other areas of development in packet radio. You may not remember much of it the first time through, but you can always refer to it when you're ready to explore those aspects of packet operation. This section is followed by chapters on portable and HF packet operation. Last but not least, there is a useful glossary of packet terms and an appendix that provides information on how to wire cables to connect a TNC or multimode controller to your rig.

I wish that I had read *How to Get Started in Packet Radio* before I took the plunge on my own. It would have saved many hours of time, effort, and frustration. If you are considering packet, you couldn't do better than to start with K4TWJ's wonderfully readable book.

How to Get Started in Packet Radio is priced at $9.95 and is available from most amateur radio dealers or direct from the National Amateur Radio Association, P.O. Box 598, Redmond WA 98073-0598. RF

the tech side

by Michael Jay Geier KB1UM

Interference and Filters

If you spend all your time in the VHF and UHF areas of the spectrum, you probably think ham radio is wonderfully clean and quiet, especially if you started out on "anything goes" CB. Well, I hate to be the bearer of bad news, but the HF bands, from 160 through 10 meters, are a mess! I don't mean that they are full of CB-type craziness (although we do have our crazies, believe me), but the HF bands are full of static, interference from other stations, weird noises, you name it. And when propagation is really good, reception can be really bad, because everybody and his brother and sister crowds the bands. Heaven help you if you happen to want to talk to a friend on a contest weekend; you might as well go swimming, 'cause it ain't gonna happen!

While nothing short of contest organizers' developing some courtesy and reserving part of each band for non-contest operation will ever solve that last problem, the static and normal interference issues are not insurmountable. You can't completely get rid of such things, but you sure can make them better. Sometimes it makes the difference between carrying on your conversation and giving up and heading for the pool. So, let's take a look at some of the solutions to the plagues of radio: noise and interference.

Who's Nancy?

On HF, you may sometimes hear someone refer to "Q.R. Nancy." No, this isn't some famous ham pioneer. Rather, the name refers to QRN, which is the Morse code shorthand for natural, as opposed to man-made, interference. Although the modern phonetic for N is November, the old Nancy has survived, although I've never heard it used for anything else.

Mother Nature is one noisy lady. Electrical activity in the atmosphere causes all kinds of noises, but it is most familiar as lightning, of course, and that sure does make one heck of a crackle in your radio, even if the bolt is dozens of miles away. In fact, if you listen on 80 or 160 meters, you can hear lightning *hundreds* of miles from your location! If you like listening to storms, it can be quite fascinating to catch them approaching long before you can actually see or hear them the usual way. Unfortunately, lightning can destroy your station and perhaps your house, and can even kill you. It doesn't even take a direct strike to do it; a nearby one can distribute enough of a charge to do the job. So, if there's an electrical storm brewing, disconnect your antennas, ground them and keep away from the gear, OK? It's perfectly safe to listen indoors on a battery-operated AM pocket radio, though, and the AM broadcast band is very good for the purpose—just tune near the bottom of the band, between stations. By the same token, talking on your walkie with a rubber duck antenna is fine, too, as long as you're indoors and using the batteries. I remember once, when I was a teenager, I was drinking from a water fountain when lightning struck about 1,500 feet away. I got a noticeable shock from the metal fountain. Ouch! If that strike had happened just a little closer, I might not be here writing this column. So, please, no ham radio with outdoor antennas or AC power during storms, OK?

Oh yeah, we were talking about QRN. The lower in frequency you go, the worse it is. Part of the reason so many 80 meter operators use big linear amplifiers is to be heard over all the static crashes. Another kind of QRN that is very common is general atmospheric hash. Some days, 20 meters is full of it, but it usually goes away at night. Especially after a solar flare, it can be really bad for a few days.

Our Own Fault

The other kind of interference with which we are plagued is Q.R. Mexico. QRM is man-made interference, and it ranges from car ignition noise to the garble of other stations too close to your frequency. Many hams try hard not to interfere with each other but, sometimes, there's just no way around it, especially on a crowded band like 20 meters. There are so many stations that it just isn't possible to stay 3 kHz away from anybody else.

The Bad Old Days

In the old days, AM was the primary voice mode. One of the characteristics of AM is that it uses a carrier. It makes a real mess when stations get too close together because the competing carriers cause a "heterodyne," or continuous whistle-like tone, in your receiver. It is annoying and painful to listen to over any period of time.

Now, most voice on HF is transmitted using SSB. Thankfully, there's no carrier, so there are no heterodynes. But SSB creates its own annoyances. Stations whose frequencies are near the high end of your receiver's passband (the range of frequencies it can hear, relative to the frequency on its display) cause "monkey chatter," which sounds like speech but is squeaky and unintelligible. Stations toward the low end cause a grumbling sound which I find even harder to listen through. Is there any way to get rid of all this junk and just hear the signal you want? Well, sometimes.

The big difference between QRN and QRM is that QRN is random and fairly constant across a range of frequencies, while QRM is more specific in form and also in frequency. So, it takes different approaches to remove them. Let's look at what's available.

Snap, Crackle . . .

Static crashes and auto ignition noise actually have something in common: Both consist of very rapidly-rising and falling pulses. In other words, they have bunches of popping sounds. The rate at which they rise is much faster than anything due to speech modulation, so it is fairly easy to make a circuit which will detect that rapid rise and mute the receiver for the fraction of a second the noise is occurring. As it turns out, the brain doesn't notice tiny moments of silence very much, so a momentary mute is much nicer than a momentary pop. Most radios have noise blankers which do a decent job. Some have adjustable thresholds and time periods, while others just have an on/off switch. The effectiveness of the noise blanker depends on its design and on the characteristics of the offending noise. Blankers are far from perfect, but they can make the difference between an ear-splitting headache and comfortable communications, especially in a mobile setup. Power-line noise, which is caused by arcing in the electric company's insulators out on the pow-

Continued on page 23

antennas, etc.

by Joseph J. Carr K4IPV

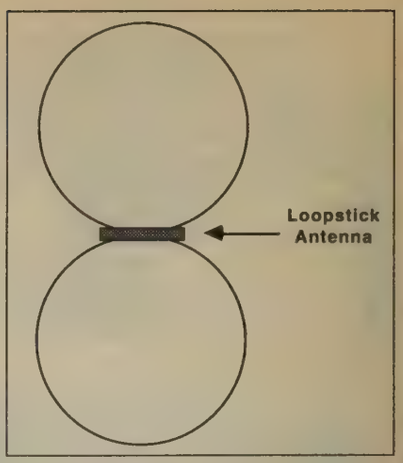


Figure 1. Figure-eight pattern of the loopstick (note orientation of antenna).

Loopstick Receiving Antennas

A lot of amateur operators use a separate antenna for receiving, and a lot of them select the desktop loopstick for the low bands (40 meters and under). The loopstick antenna is similar to the small loop (discussed in a previous column) in that it has a figure-eight pattern that exhibits broad maxima lobes and very sharp nulls. These nulls are what makes the loopstick good for direction finding, and for placing an offending co-channel or adjacent channel signal into the trash can. The idea is simple: Position the null on the interfering signal and it will attenuate him or her while not materially affecting the desired signal . . . provided that the offending signal is not on the line that passes through both your location and the location of the desired signal.

The loopstick antenna consists of a ferrite rod wrapped with wire (Photo A) and covered with tape in order to keep the wire in place. The wideband variety of loopstick does not resonate the loop. The examples shown in Figure 2 are tuned. In Figure 2A the main coil is split between two ends, and a split-stator capacitor is used to resonate it. A small coupling coil carries signal to the receiver. In Figure 2B the entire loop is resonated by a single capacitor, and the inductor is tapped for the signal connection. This loop is based on the Amidon Associates [2216 East Gladwick Street, Dominguez Hills CA 90220; tel. 213-763-5770 (voice) and 213-763-2250 (fax)] FB-43-101 ferrite rods.

First, wrap the rod with a single layer of either black electrical tape or that white Teflon tape used to waterproof plumbing pipe threads. Next, wrap the rod with wire. It is best to use either #24 or #26 enameled or Formvar-covered wire. From the center, the ferrite rod is wrapped with about three feet of the wire in each direction (leave 1/8 to 1/4 inch of rod free at the ends). Cut off the excess wire. Next, cover the wire with an additional layer of tape to keep the wire in place.

Coupling to the receiver in the loopstick shown in Figure 1 is through a small winding consisting of 5 to 10 turns of wire. This winding is electrically separate from the resonating coils, but is magnetically coupled to them. The coupling winding may or may not be tuned, but tuning of the main coil is highly recommended. In my own experiments, I couldn't find a significant difference between tuning or not tuning the coupling coil, so I tend to leave the capacitor (C2 in Figure 2A) out for the sake of simplicity.

The loopstick shown in Figure 2A is tuned by a dual capacitor, or "split-stator" capacitor. In this case each segment is tuned separately, but with capacitors that are ganged to the same mechanical shaft. For a contrast, see the single-tuned loopstick shown in Figure 2B.

The two windings of Figure 2B are connected together and then soldered to either a single wire "downlead" to the receiver or the center conductor of a length of coaxial cable (or coax connector). In some cases, the shield of the coax is not grounded. Experiment with it to see which is proper for your case. Sometimes, connecting the shield to ground at the receive end reduces signal levels, but in other cases it apparently does not.

Loopstick antennas suffer from an "antenna effect," i.e. interaction with local conductors and the ground. This effect is overcome by using an open U-shaped shielded enclosure for the antenna. The rod is mounted to an insulated stand-off with nylon machine screws and hex nuts. The loop is held to the

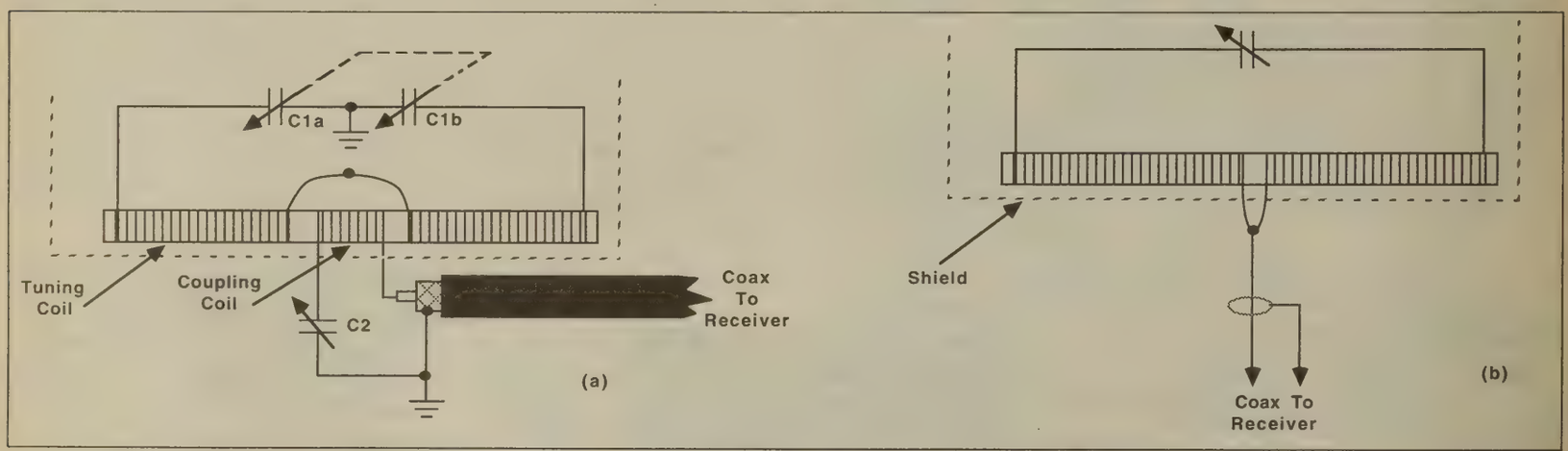


Figure 2. A) Double-tuned loopstick; B) single-tuned loopstick.

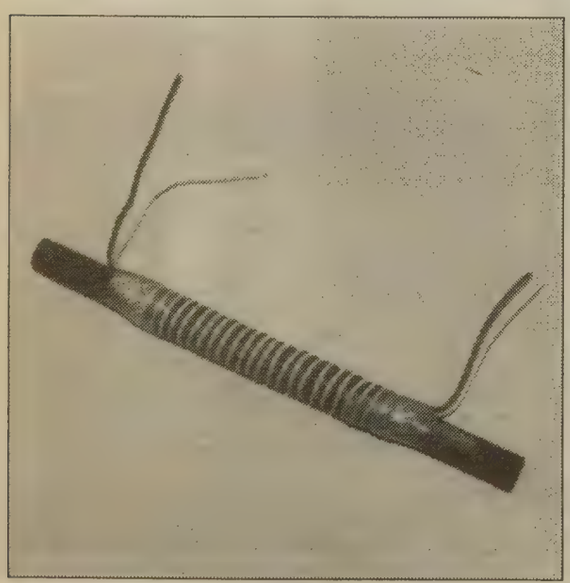


Photo A. Ferrite rod wound with wire forms a loopstick antenna.

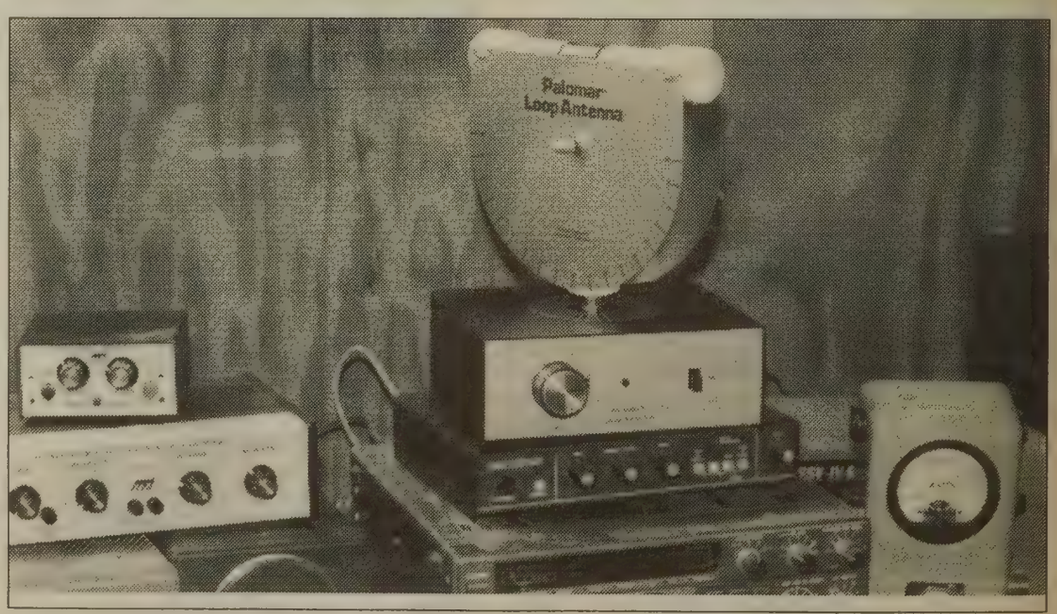


Photo B. Palomar loop and LA-1 preamplifier.

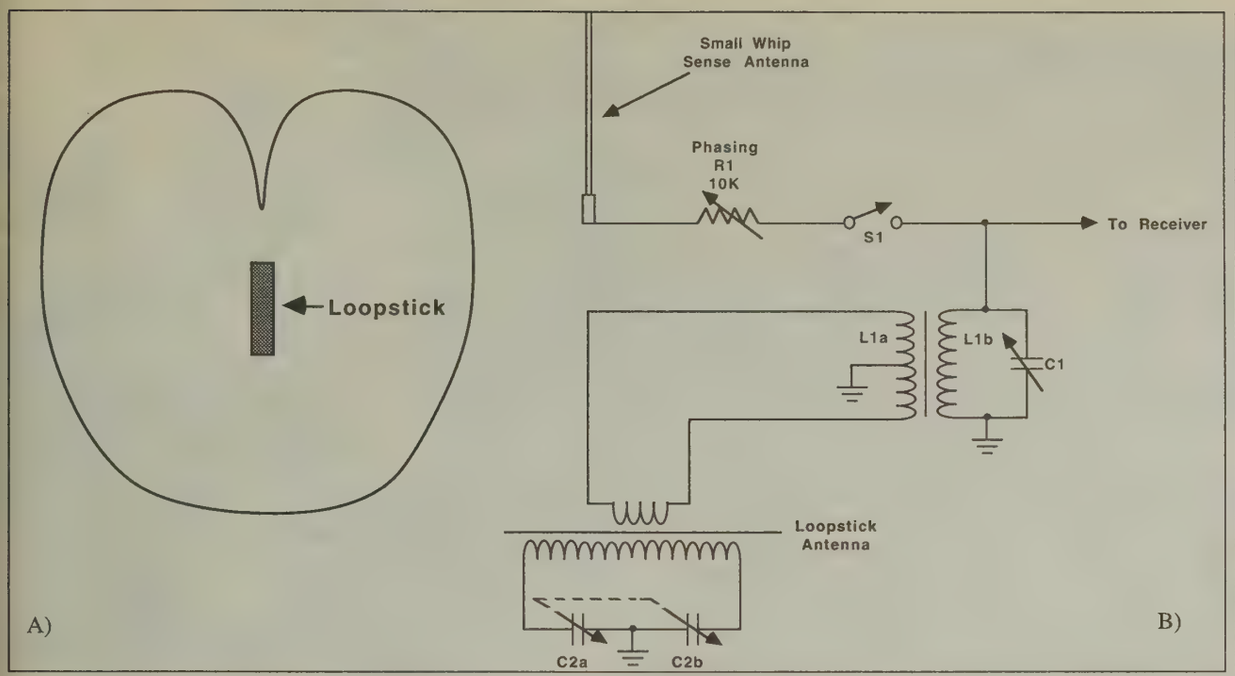


Figure 3. A) Cardioid pattern of loop; B) circuit for antenna.

stand-off using a plastic or nylon cable clamp.

If you're not into building loopstick antennas, then there are commercial models available. I've used the Palomar Engineers (P.O. Box 455, Escondido CA 92033; tel. 619-747-3343) Model LA-1 loop amplifier and frequency selective loop (see Photo B). The particular loop shown here is the Type BCB, which is intended for the AM broadcast band (550 to 1630 kHz). Other models of loop, which also mate with the LA-1 loop amplifier, are available for the shortwave amateur radio and international broadcast bands.

The Palomar loop is a resonant type. A tuning control on the LA-1 allows the operator to resonate the loopstick to the received signal frequency. The loop can be adjusted for azimuth because it can be rotated in the horizontal direction. It can also be rotated +/-90 degrees in elevation. This latter ability is useful on most bands because the skywave may arrive at an odd angle, other than horizontal, especially if it is distorted by local buildings or other structures.

Figure 3A shows a case where the antenna pattern is cardioid (i.e. heart shaped). In this case, the antenna pattern is altered from the figure-eight pattern by using a "sense antenna" (see Figure 3B) The sense antenna is an omnidirectional whip, 14 to 24 inches long, that is connected to the antenna circuit through a phasing potentiometer. A portable radio replacement whip or homemade whip will suffice for the sense antenna. The sense antenna is used to reduce one lobe and make the antenna essentially monodirectional (Figure 3A). This is the configuration needed for radio direction finding because it makes the direction of the null unambiguous. With the bidirectional figure-eight pattern it's always a guess which of the two nulls is placed in the direction of the station.

Radio direction finding is done by finding the null on the station of interest. The null is a lot deeper than the peak so it gives better directional resolution. Finding the null direction from a single location results in a line to the station, but you don't know where on the line it is located. Finding the null direction from three locations, a process called triangulation, results in a fair degree of accuracy in locating the station . . . all three lines cross very close to the transmitter site on a map. RF

the tech side

Continued from page 21

er poles, also can be greatly reduced by noise blankers. You'd be surprised at how many suburban hams suffer from this kind of noise. Although QRN crashes sometimes can be reduced, as a rule they don't respond as well because they don't rise as fast, so the blanker often doesn't catch them.

Clamp Down Tight

The bandwidth of your receiver is related to the mode you are listening to. If you're listening to SSB, you need about 3 kHz of width, although it's possible to understand speech with as little as 1.8 kHz. If, however, you're listening to CW (Morse code), you may need only about 200 Hz! The wider your receiver's bandwidth, the more noise it can let in. So, it pays to use as narrow a bandwidth as possible. But, if you narrow it down too much, voices will become muffled and CW will get so muddy that you can't tell when the dits and dahs begin and end! So, it's always a compromise.

Crystal Power

Crystal or ceramic filters are used in ham rigs to define the bandwidth. Most of them have pretty steep skirts, which means that the range of frequencies between where they start to cut things off and where they completely cut them off is narrow. The steeper the better; there's no use letting more through than you want. Those filters go a long way toward removing adjacent stations, but they (the filters) have the disadvantage of being fixed; you can't change their widths. Better radios, however, often have IF shift or variable bandwidth tuning controls which move some oscillator frequencies around and shift the signal with respect to the filter. Since it's all relative, it doesn't matter which one shifts, so the effect is exactly the same as if the filter's frequency itself were changing. So, if you have some LID (Lousy Inconsiderate Dummy) tuning up just above you or starting up a conversation too close to your frequency, you often can reduce the interference with these controls. There's a limit, of course; as I mentioned before, signals get hard to understand when the bandwidth's too small. But, it's a lot more pleasant to listen to a somewhat muffled voice than loud monkey chatter or grumbling.

The Deep and Narrow Path

Remember I mentioned that SSB caused no heterodynes? Well, that's true when people are talking. But, when someone is tuning up a transmitter or amplifier, or adjusting a tuner, a carrier must be used, and it sounds just like any carrier. In other words, the squeal is back.

A special circuit called a notch filter can suck that noise right out of there. Usually operating in the IF (Intermediate Frequency) stages of the radio, this filter is not made from crystals or ceramics, so it's tunable. You just turn it on and adjust the control until the filter matches the pitch of the tone, and the whine magically disappears. Unfortunately, this cuts a "notch" in the radio's passband (hence the filter's name), and that does affect the sound a bit. Really sharp notches, though, are not too intrusive. A good sharp, deep notch filter works wonders on "tuner-uppers" and it is equally good at getting rid of adjacent CW stations because CW is just a constant-frequency tone anyway. It does no good, though, with adjacent voice stations, because voice signals contain lots of varying pitches and the notch filter is designed to cut out only a very narrow range.

Some rigs also have just the opposite of a notch filter. This one's called a peak filter. Usually, it's in the audio stages, and you turn its knob to bring up the signal you *want* to hear, thus bringing down all the others. Like a notch filter, a peak filter is a very narrow device. So, it's really useful only on CW, where the signal you want to hear is nice and narrow. If the filter were wide enough for a voice signal it wouldn't do much good at getting rid of anything.

That about covers the filters available on today's transceivers. It would seem that they all involve a lot of compromise, right? Well, they do, but now there's a whole new genre of filtering that's becoming available, and it can do amazing things. Some new filters can even remove adjacent voice stations without messing up the one you want to hear. Others can remove multiple heterodynes at once! Next time, we'll take a look at those. For now, though, 73 from KB1UM and see you next month. RF

upgrade . . . don't stop now

by Gordon West WB6NOA

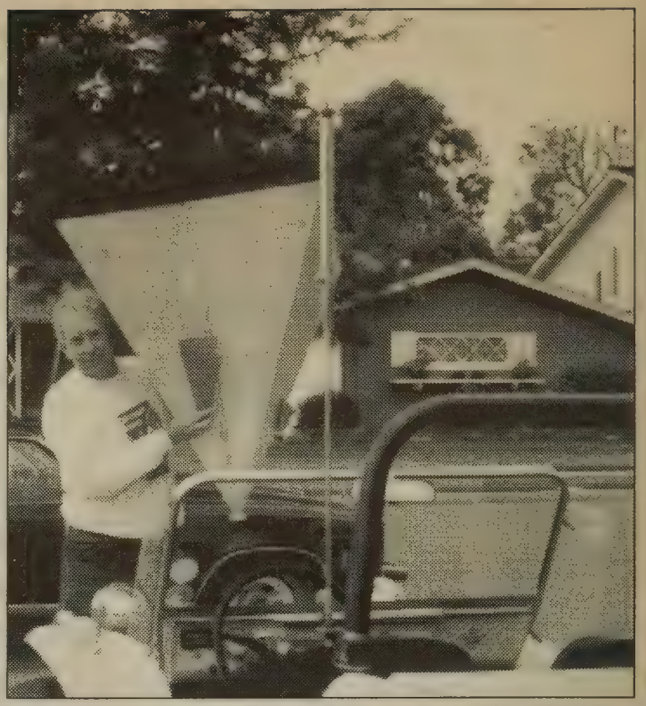


Photo A: "Gordo" WB6NOA goes tropo-ducting with his dune buggy and "super horn" microwave antenna system.

Understanding Weather and VHF/UHF DX

If you learn to watch your local weather conditions, you may reliably predict a fascinating summertime VHF and UHF radio phenomena called *tropospheric ducting*. During periods of tropo activity, you can easily access distant repeater stations two or three states away! In fact, the tropospheric duct may become so pronounced that a distant repeater 300 miles away will actually override, via capture effect, your local repeater (only 50 miles away)!

Down on the worldwide bands, 160 meters through 10 meters, weather conditions have absolutely no effect on your maximum range capabilities utilizing ionospheric refraction. Whether it's hot and sunny, or cold and snowy, your worldwide signals still bounce off the ionosphere and travel thousands of miles.

From 2 meters on up, FM communications, as well as weak signal and satellite SSB and CW communications, are dramatically effected by summertime tropo ducting. These tropo conditions occur from July through September, and may be referred to as an inverted mirage. Your VHF and UHF signals that normally travel in a straight line will enter this inverted mirage, and will travel hundreds and thousands of miles beyond their normal "line of sight" range. During the tropo event, VHF and UHF line-of-sight signals that are usually lost in space are bent back to the curvature of the earth, and go, and go, and go! The mirage normally sits at about 1,000 feet, and acts as a radio mirror to VHF, UHF and microwave signals.

What causes an inverted mirage? The answer was on your Technician Class examination, and the cause is a temperature inversion that is greater than 8 degrees Fahrenheit within a 200-foot band, with cold moist air below, and cold dry air above. Under normal weather conditions the radio refractive index of air, represented by the symbol "N" for "normal," is slightly above 1—specifically 1.000345. Pressure decreases with height in a logarithmic manner at about 1 mb (millibar) for every 10m (miles) in altitude. Temperature decreases 20 degrees Fahrenheit for every mile of increasing altitude in the troposphere, up to approximately 40,000 feet. Along with temperature and pressure dropping, water vapor also drops.

But when the summertime high pressure system comes in over our area, the high pressure "cell" may begin to become more heavy than what it might contain, and air begins to drop out of the cell down toward the earth. As you squeeze more air down close to the earth, it heats up. But very close to the earth—usually less than 1,000 feet—light winds may create a boundary where all this warm squeeze air bottoms out. It is this sharp boundary that creates a well-defined temperature inversion over a large area of the United States, and this temperature inversion may be strong enough to cause VHF, UHF and microwave signals to refract along the boundaries of the high pressure cell.

Here are some of the popular summertime, stable, high pressure, tropospheric ducts:

- The Pacific high, between Hawaii and California.
- The Continental high, between the Great Lakes and Texas.
- The Gulf high, between Texas and Florida.
- The East Coast high, between New Hampshire and Florida.

If you regularly watch your evening weather report, pay particular attention to the weather forecaster's report of a stationary high. If this high pressure system has not moved for more than five

days, get set for tropospheric ducting—especially if your local weather is hot, smoggy and smoky, and has little surface wind.

Turn on your 2 meter FM transceiver and tune in any one of the following frequencies that may NOT be a local channel for you:

146.940 MHz
146.880 MHz
146.820 MHz
147.060 MHz
146.910 MHz
146.950 MHz
147.060 MHz
147.030 MHz

You may also try to tune in a distant VHF/FM weather channel that your set may be able to tune in:

162.550 MHz
162.400 MHz
162.475 MHz

You may need to turn off your squelch in order to pull in reception to a distant station. If you have a mobile antenna, or better yet a single-band or dual-band outside antenna hooked into your handheld or VHF/UHF set, all the better! The more antenna you have, the better it is to take advantage of tropo ducting.

You may be surprised to find considerable repeater traffic on frequencies where normally you don't hear it. The signal may be so strong that you are convinced someone has put up a new repeater in town. Maybe not. You may be hearing the signal over 300 miles away! Wait for the identification, and then copy the CW or voice IDer. If you are just learning the code, tape-record it and play it over and over again until you can figure out the callsign. Then look it up in a *Callbook* or a callsign database. This gives you an idea of what system you have tuned in.

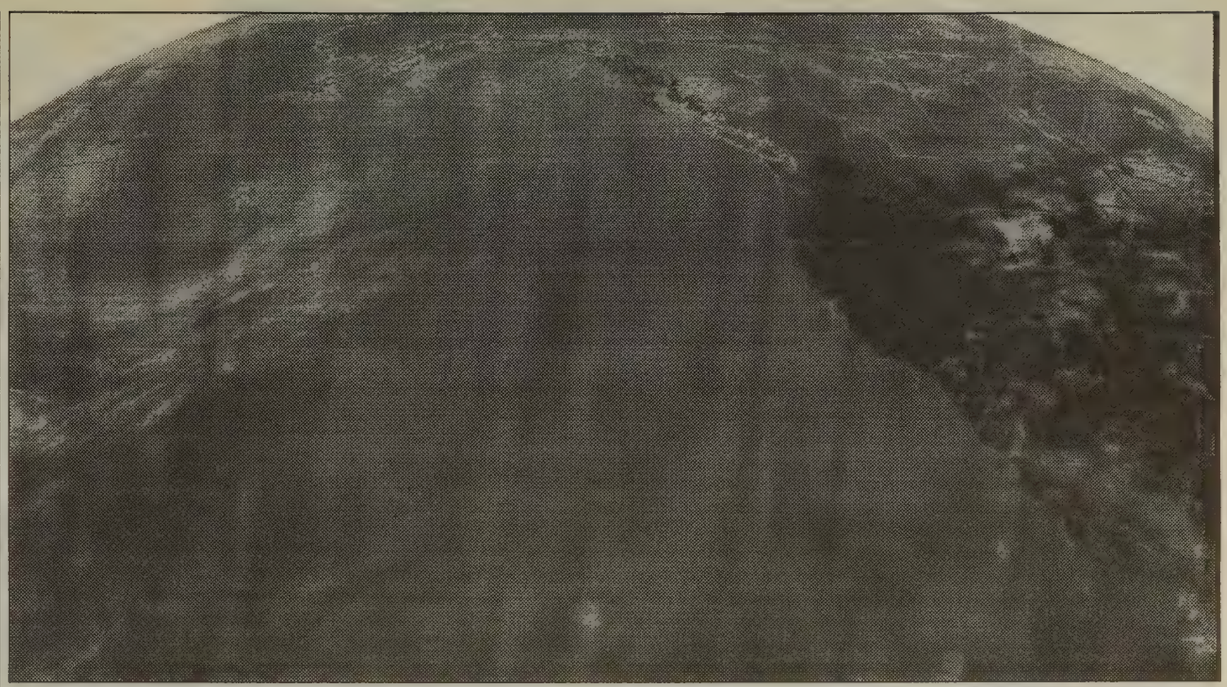


Photo B: WEFAX (weather facsimilie) imagery illustrating good tropo conditions of undisturbed air between Northern California and the tip of the Mexican Baja Peninsula.

When there is a pause in the conversation, attempt to make contact through that distant repeater. You'll need to set your transceiver's offset to either +/-600 kHz for the 2 meter band, or -5 MHz for the 70cm band. If the repeater is open without CTCSS access required, you are all set to hook up with another station hundreds of miles away.

It's always helpful to say your local city, too. And if tropo conditions are really great, say your state, too. You may find some very surprised repeater operators disbelieving that you may be as far away as you are. Just tell them, "Welcome to tropospheric ducting."

If you have a television set hooked up to an outside antenna, look to your normally vacant TV channels for distant TV DX. This can be exciting, too.

Tropospheric ducting conditions will usually last for two or three days, until the weather system begins to change. Signals usually remain strong, and don't have the cyclical variations in strength that you would normally experience with 6 meter and 10 meter ionospheric DX. Tropo conditions peak about 10 a.m., and also about sundown. It's entirely possible that the strength of the incoming distant signals will be so strong that your bargraph S-meter will stay completely illuminated for days on end when the distant repeater is on the air.

Just last summer a station in Hawaii came up on a local Southern California repeater and talked for literally days before the tropospheric duct finally "blew out" (KH6IAA via the Catalina Island repeater). So get set for some summertime DX on VHF and UHF. Become a tropo expert, and watch those weather maps. RF

RF review

Antennas West
1500 North 150 West
Provo UT 84604
Telephone: (801) 373-8429
Price (30 meter version): $59

Antennas West Half Square

by James H. Gray W1XU

I received and erected my "half square" antenna just one week ago today. I suspended it between two pine trees at approximately 30 feet above ground, and oriented it so that its broadside direction was WNW and ESE (west-northwest, east-southeast). It is fed at the WNW corner with 50 ohm RG58/U coaxial cable.

To date, I have worked stations in 12 states and 12 foreign countries. Not bad, considering the propagation over the past six days. Conditions on the 30 meter band have been far from normal, and during the six days preceding this report there have been two minor magnetic storms, as well as daily WWV values of Solar Flux from 95-105; Boulder A index of 1-55; and Boulder K index of between 1 and 5. These indicate flux "Very Low to Low" and "A" and "K" levels of active-to-minor storm levels for the magnetic field of the earth. Altogether "horrible" conditions, as expressed by many stations I've contacted.

Compared to other antennas available to me (30 meter loop and Butternut HF-6V), roof-mounted, the half square's performance is outstanding, even under the worst conditions possible short of total blackout.

Description

The half square antenna may also be called an inverted "U," which consists of two quarter-wave vertical elements separated by a half wavelength horizontal phasing line. The antenna is fed with coaxial cable at one corner of your choice, between the horizontal phasing line and one vertical element. The center conductor of the coaxial feedline is connected to the vertical element, and the outer shield braid is connected to the horizontal phasing line by means of a rugged, waterproof connector which serves as a means for suspending one end of the antenna and its feedline. The other end of the antenna with its vertical element is suspended from another support (pine tree) by means of a tough but light insulator made from a special plastic material. The ends of the vertical elements are allowed to hang free vertically and are terminated in two insulators identical to the one described above. These may be weighted to hang free but straight, or (as in my case) snubbed to a convenient bush to prevent swaying in the wind and to help maintain the verticals parallel with each other. The "free" ends, however, must NOT touch the ground.

The wire is a special flexible wire which is covered by a tough and slippery insulating material for both weather protection and ease of passing over branches or around obstacles. The wire which forms the phasing line-cum-vertical elements is a number 14 multistranded copper wire, specially wound to prevent separation of the strands, and is virtually kink-proof. The weatherproof connectors and insulators are specially molded to Antennas West specifications.

The feedline (coax) and the support line are provided by the end user (you or me), but they may be obtained in several different sizes and strengths from Antennas West, and so can the coaxial cable itself.

Each half square antenna is a single-band antenna and is considered a dedicated antenna for that band. (I confess, however, to having used it on 20 and 40 meters by means of a tuner . . . and, not surprisingly, it worked very well on these "off" frequency bands). As erected for the single band of your choice, the half square presents a nominal feed-point impedance of approximately 60 ohms, which has some change in value with height above ground but will match either 50 ohm or 75 ohm coax with a VSWR of less than 2:1 anywhere in the 30 meter band. Note, however, that 30 meters is a small "percentage bandwidth" band which means that when the antenna is "cut" (sized) to this band, it will cover the band from one end to the other without much change in impedance or reactance at the feed point.

There are several advantages to the user of a half square antenna. First, it is NOT a compromise antenna; in fact, it is a full wavelength long but occupies a horizontal space of only a half wavelength (46 feet on 30 meters) and a vertical space of only a quarter wavelength (23 feet on 30 meters). Thus, it is very convenient to put up and contain within an average yard or lot. A pole, a tree or mast, or even one part of your house, can be used to support one end of the antenna. If your house is big enough, both ends can be supported by the house. It is a "low profile" antenna—it's hard to see when put up and in use—but best of all, it has GAIN over a dipole of about 2 dB (4 dB over an isotropic—that is, free space, antenna). This means that your signal will be stronger in the antenna's favored directions; namely, in a direction broadside to the horizontal phasing line . . . much like a stretched and narrowed figure-eight radiation pattern compared to the "fat" and short pattern typical of the dipole. One other particularly valuable advantage of the half square is that it is relatively ground independent, meaning that it operates well over ground having poor conductivity . . . unlike some other antennas, such as ordinary verticals. The half square radiates a vertically-polarized signal at low angles above the horizon which means that it will put your signal out farther instead of close in to your station. It is a "DX-getter" type of antenna, and my 30 meter version radiates its main lobe of RF energy at about 19 degrees above the horizon.

Photo A. The half square 30 meter antenna from Antennas West.

Although the half square does, indeed, radiate its signal best in directions broadside to the antenna, this is not by any means intended to say that it won't work close-in stations "off the ends." In fact, I consistently get S9-strength reports from stations off the ends and out to about 1,000 miles. Just ask Roy K6XK, or Bob WB8NPZ, or Morley K7UM about this.

What else is to be said, you wonder? Well, many things—some within the scope of this review and others not—but in general it is a MOST satisfactory antenna for this station, where I spend most of my operating time on 30 meter CW. To summarize, it is neat, convenient, easy to put up, low-profile, lightweight, has 4 dB gain, and costs less than you would expect. The various dedicated half square antennas from 160 through 10 meters (on the band of your choice) have various prices commensurate with size. The suggested price of my 30 meter version is only $59 . . . a real bargain, considering the quality of materials and ready-made convenience. It will last for years under almost any weather conditions of wind, smog, acid rain, desert sun, ice or what-have-you. I particularly like the weather-protected connector for the coaxial cable feedline, and the adjustable insulators which allow you to adjust the length of the horizontal phasing line and the vertical elements to suit your own particular frequency within the band, for best performance on those bands having a large percentage bandwidth-to-spot frequency within the band, such as 80 meters and 10 meters. You can make your own length adjustments easily and within a minute or two to suit your own specific needs. In fact, it is possible to make the antenna fit your own lot by changing vertical and horizontal lengths without drastically reducing its performance.

Thus, you have a versatile antenna as well as an outstanding performer. For those who wish to know more of the history and theory behind the half square, I encourage you to send to Antennas West for their booklet about the antenna. It makes fascinating reading and presents theory in such a manner that it is enjoyable and fun. These antennas have been used all over the world but, strangely, you don't hear much about them. Perhaps a half square at YOUR station will help change that! RF

what's next?

by Carole Perry WB2MGP

Photo A: Gordon West works the "CQ All Schools Net." Demonstrations like these create excitement in the classroom.

Teaching the Teachers

What a good time we all had at the workshop for teachers and instructors at Dayton '93! I organized this forum specifically to highlight highly motivational teaching techniques and to share with educators some sure-fire lessons that never fail to generate excitement in a classroom. Gordon West WB6NOA addressed the needs of instructors who work primarily with adults. I handled the teaching ideas for the folks who work with youngsters.

I noticed that several of the children who were going to be in my youth forum the next day were in the audience. I introduced these talented young people to the rest of the group and invited everyone to come to see and hear them so that they could get good ideas for recruiting directly from the children themselves. I gave a little talk about how effective these youth forums can be. Children love to watch other kids on the videotapes we show them, and they certainly pay attention to what their peers have to say.

I showcased some useful items the major manufacturers offer to amateur radio teachers. ICOM, Kenwood, and Yaesu have many promotional tools that are great to use or display in a classroom. As a teacher, when you write to them requesting wall maps or spectrum charts, be sure you do it professionally, on school stationery, so that they know their materials are going to the right place. Very often they give away hats, key chains or notebooks, which I use as prizes for our ham radio bingo games.

We went over the various training materials that are on the market today. I encouraged the group not to be afraid to try new books and tapes if the ones they're using don't work for them. Some people respond to different techniques. In my classroom, I try to offer a wide variety of manuals and tapes for the children to use. I choose one book for the instructional lessons from each term, and allow the children to select their preferred audio cassettes and reading material when they do their individualized studying in class. Every term I vary my own book and continuously update the collection with new materials. This way, the course stays fresh for me too.

At these workshops, both Gordon and I always stress our belief that the success or failure of most amateur radio courses depends on the instructor. An enthusiastic, involved teacher rarely has any significant dropout rate. We always caution clubs that are organizing license classes to spend considerable time selecting the right person who will be in front of the class. Don't make the mistake of believing that the person who is the most knowledgeable is necessarily the best one for the job.

In 1993 no teacher should have to reinvent the wheel searching for classroom materials. Today, there are lots of resources available free for the asking. The ARRL Educational Activities Department will send lots of booklets, comic books, charts, and other materials for classroom use if you contact them at 225 Main Street, Newington CT 06111. Gordon West, NARA, and I all have commercially prepared packages to use in the classroom. Examine the materials ahead of time to determine which ones best suit your own particular needs. There are also plenty of people with successful teaching track records who will offer their assistance and materials for the asking. Please consider me as one of those resources.

Meanwhile, back at Dayton, Gordon showed our audience what we mean by making lessons fun and exciting. He performed his famous pickle demonstration by inserting a nice juicy pickle on the plugged-in telegraph key to demonstrate the principle of conductivity. He also involved the audience in his various demonstrations, which is an excellent teaching technique.

I think that everyone had a good time. At the very least, participants left knowing that amateur radio in the classroom can be a fun learning experience.

If you are a new teacher of amateur radio who is looking for some good ideas to get started with, please contact me at P.O. Box 131646 Staten Island NY 10313-0006 or call (718) 983-1416. RF

activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

JULY 10

OAK CREEK, WI The South Milwaukee ARC will hold its 23rd annual "SWAPFEST" at American Legion Post #434, 9327 South Shepard Ave., from 7 AM-2 PM. Talk-in on 146.580 MHz FM simplex and most local rptr. freq. For details and a map, contact *The South Milwaukee ARC, P.O. Box 102, South Milwaukee WI 53172-0102. Tel. (414) 762-3235, ext. 58.*

PETOSKEY, MI The Straits Area ARC Swap & Shop will be held at Emmet County Fairgrounds from 8 AM-1 PM. VE Exams at 10 AM. Call *Harry Leiber N8OIV, (616) 347-6610.*

SALISBURY, NC The North Carolina Chapter of the Triple States RAC will sponsor a Firecracker Hamfest at Salisbury Civic Center from 9 AM-4 PM. W5YI-VEC Exams (pre-register with Form 610, copy of license and $5.60 to *Isabell Ledford, P.O. Box 826, Coolemee NC 27014*). Talk-in on 146.985/.625. Contact *Walter Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071.*

SUMMERVILLE (CHARLESTON), SC The Trident ARC will sponsor CHARLESTON II - Summer HAMFEST & Computer Expo at the Charleston Exchange Club Fairgrounds from 0830-1430 hrs. True-Auction at 1450 hrs. Talk-in on 147.27+, 146.52. For info, call *Scott WB3EFS, (803) 572-9459.* To pre-register, call *Gordon N4JNU, (803) 851-2165.* Vendors contact *Bubba N4CII, (803) 821-8100.* Address all inquiries to *Charleston II, c/o TARC, P.O. Box 73, Summerville SC 29484.*

JULY 11

AUGUSTA, NJ The Sussex County ARC will sponsor "SCARC '93" at the Sussex County Fairgrounds, Plains Rd., off Rte. 206. Doors open at 8 AM. Talk-in on 147.90/.30, 222.90/224.50, and 146.52. Contact *Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849. Tel. (201) 663-0677.*

BOWLING GREEN, OH The Wood County ARC will be celebrating its 28th annual Hamfest from 8 AM-1 PM, at the Wood County Fairgrounds. VE Exams. Talk-in on 147.18/.78. Contact *W.C.A.R.C., P.O. Box 534, Bowling Green OH 43402. Tel. (419) 352-0856.*

BREWSTER, NY P.E.A.R.I., the Putnam Emergency and Amateur Rptr. League, will sponsor their annual "PEARLFEST" Hamfest and Fleamarket at Brewster High School on Foggintown Rd., from 8 AM-2 PM. VE Exams. Talk-in on KG1O rptr/145.130 -600. Contact *Shirley Dahlgren N2SKP (914) 736-0717.*

PITTSBURGH, PA The 8th annual Hamfest sponsored by the North Hills ARC, will be held from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. Talk-in on 147.09, the North Hills ARC Rptr. Get details from *Don Jackson N3LAZ, 8 Dale Ave., Bradford Woods PA 15015. Tel. (412) 935-3343.*

JULY 16-18

EAST GLACIER, MT The Glacier-Waterton Internat'l Hamfest will be held at Three Forks Campground, 16 miles west of East Glacier Park, on Highway #2. VE Exams. Contact *George Smith KC7OD, 1822 14th Ave. South, Great Falls MT 59405. Tel. (406) 452-5958.*

JULY 17

WELLINGTON, OH "NOARSFEST" (sponsored by the Northern Ohio ARS) will be held at the Lorain County Fairgrounds on Route 18, beginning at 8 AM. Contact *Dee Dee Ohman KA8VTS, 4122 Bush Ave., Cleveland OH 44109. Tel. (216) 398-8858* between 6 PM and 11 PM EST weekdays; anytime on weekends.

JULY 18

CAMBRIDGE, MA A TAILGATE electronics, computer and amateur radio FLEA MARKET will be co-sponsored by the MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, from 9 AM-2 PM at Albany and Main St. Talk-in on 146.52 and 449.725/444.725 - pl 2A W1XM/R. Contact *Steve Finberg W1GSL, P.O. Box 82 MIT BR, Cambridge MA 02139. Tel. (617) 253-3776.*

VAN WERT, OH The Van Wert ARC will hold their "Hamfest 93" at the Van Wert County Fairgrounds (US 127 South) from 8 AM-4 PM. For VE Exams, contact *Bob High KA8IAF, 12838 Tomlinson Rd., Rockford OH 45882; (419) 795-5763,* (deadline July 10th). For Hamfest details, call *Jack WD8MLV, (419) 495-2209, before 5 PM;* or *Bob WD8LPY, (419) 238-1877, after 5 PM.* Talk-in on 146.850

WASHINGTON, MO The Zero Beaters ARC will hold its 31st annual Hamfest at the Bernie H. Hillerman Park (Washington Fairgrounds) from 6 AM-3 PM. VE exams at 10 AM. Contact *Ed Southall WD0ELL, P.O. Box 24, Dutzow MO 63342. Tel. (314) 459-6581,* or *(314) 239-0060.* Talk-in on 147.240+ rptr.

Continued on page 28

Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 30,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 25 cents a word for individual (noncommercial) ads, and 80 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to *Radio Fun Flea Market*, Judy Walker, 70 Route 202 N, Peterborough NH 03458, and *get set for the phone calls.*

The Deadline for the August 1993 Flea Market is June 22, 1993.

SENSATIONAL NEW WAY TO LEARN CODE-Do Aerobics, Sing, Jog, or **Drive** while learning code! **Now** the secret is yours! Order **THE RHYTHM OF THE CODE-Morse** code music cassette today! $9.95 ppd **KAWA RECORDS**, P.O. Box 319-R, Weymouth MA 02188. The **HIT** of the 1993 Dayton Hamvention! RF247

MINIATURE POLICE RADAR TRANSMITTER one mile range, $41 assembled, $31 kit, (219)489-1711. P.O. Box 80096, Fort Wayne IN 46898. RF251

AMIGA, MACINTOSH, ATARI XL/XE/ST Amateur Radio PD Software $4.00 disk. Two-stamp SASE brings catalog. Specify computer! **KINETIC DESIGNS HAMWARE** Box 1646, Orange Park FL 32067-1646. RF266

HOMEBREW COMPONENTS. Large SASE brings catalog. **KA7QJY COMPONENTS**, Box 3893, Logan UT 84323. RF271

LIKE NEW: ICOM IC765 with FL101, 102, 55A and ICSM-6 mic, $2,000 firm. Call (304)457-3200 or (304)457-4372 John N8MBT. RF410

BROWNIES QSL CARDS since 1939. Catalog and Samples $1 (refundable with order). 3035 Lehigh Street, Allentown PA 18103. RF475

WANTED: SCHEMATIC Siltronix model 1011-C, copy ok, reasonable fee. (704)333-9363 EST. RF495

AMPLIFIER GREAT FOR 10 METER or other HF bands. 4Watts in CW=200 out; 25Watts in SSBin-750 out PEP, $160.00. **N0NUW**, 1608 4th Ave. N.W., Austin MN 55912. (507)437-1784. RF510

RCI-2950 OWNERS: New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only $20.00 ppd in U.S. (Missouri residents add $1.15 tax). **SCOTT**, PO Box 510408, St. Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D. RF515

INEXPENSIVE HAM EQUIPMENT. Send stamp for list. WA4DSO, 3037 Audrey Drive, Gastonia NC 28054. RF559

PRINTED CIRCUIT BOARDS for *73 Magazine* projects. Drilled, plated, G10. Techno Whizzy-1 VFO, $7.50; Matrix, $8.00; Amp, $5.50. Also boards for *QST, HamRadio, Nuts & Volts; Electronics Now; ETI Magazine*; ARRL Handbooks. Full list free. U.S. orders DEDUCT 20%. **B-C-D ELECTRONICS**, Box 20304, 858 Upper James Street, Hamilton Ontario, Canada L9C-7M5. RF585

OFFERED PEANUTS For Your Trade-In Rig? I pay cash! **RADIO RECYCLERS**, 7730 W. National Ave., West Allis WI 53214. (414)771-7121. RF625

WANT A SUPERIOR KEY? Hi-Mounds paddle, handkeys, bug, thigh strapped mobilekey, have smooth responsive handling. Eye-catching quality, appearance, eliminate fist fatigue! SASE information. **K8XF**, 9929 Foxsquirrel Dr., Newport Richey FL 34654-3517. RF635

FINALLY AVAILABLE! A rugged, reliable, reasonably priced handheld carrying case, $18.95. Lifetime Warranty. **THE CASE** (800)276-6179. RF670

RADIO TRANSCRIPTION DISCS WANTED. W7F1Z, Box 724, Redmond, WA 98073-0274. RF700

FREE Ham Gospel Tracts. SASE. **N3FTT**, 5133 Gramercy, Clifton Heights PA 19018. RF960

CONNECTICUT'S favorite ham store. **ROGUS ELECTRONICS**, 250 Meriden-Waterbury Turnpike, Southington CT 06489. (203)621-2252. RF994

SECRET SCANNER Frequencies: Federal, Police, Aero, Military, Cellular, Surveillance, also SWL & CB Books. Big FREE catalog! **CRB RESEARCH**, Box 56-RF, Commack NY 11725. RF996

AMATEUR RADIO REPAIR!! All makes & models, average labor per unit, $96.00. **W7HBF, DAN RUPE,** 1302 S. Upland Dr., Camano WA 98292. (206)387-3558. RF999

activities

Continued from page 27

JULY 24

GOWANDA, NY The 4th annual Swap 'N Shop, presented by the Tri-County ARS, will be held at Gowanda Firemans Grounds, Sand Hill (Rt. 62), beginning at 7 AM. Talk-in on 146.745 rptr. Contact *Andy K2ISN, (716) 532-2250;* or *Tom KD2EG, (716) 532-5743.*

LANCASTER, PA A Computer & Electronics Show will be sponsored by the Red Rose Repeater Assn., from 9 AM-3 PM, at McCaskey High School. Talk-in on 147.015/.615. Contact *Wade Mackey, 5 Sunrise Terrace, Millersville PA 17551. Tel. (717) 872-5328.*

JULY 24-25

MANCHESTER, NH The New England Div. Convention will be sponsored by the New Hampshire ARA, and willl be held at The Center of New Hampshire Conference Center, from 8 AM-4:30 PM. Walk-in VE Exams. Talk-in on 146.85- (wide area), 147.255+ and 223.9 (local). Contact *New Hampshire ARA, P.O. Box 573, Derry NH 03038.*

WOODLAND PARK, CO The Mountain ARC will hold its 12th annual Swapfest/Campout in the Colorado Rockies at Red Rocks Campground in the Pike Nat'l Forest (4 miles north of the city center on Hwy. 67). Campers: Advance reservations are a must. Talk-in on 146.82 rptr. Get details from *Bob, (719) 687-9025;* or *Fred or Patty, (719) 687-9727.* For reservations or info sheet, write *MARC, Box 1012, Woodland Park CO 80863-1012.*

JULY 25

BALTIMORE, MD The Baltimore Radio Amateur Television Soc. (BRATS) will hold its annual Maryland Hamfest and Computer Fest at the Timonium Fairgrounds. VE Exams will be given at 10 AM only. Pre-registration is required. Call *Les McClure W3GXT, (410) 833-8667* to pre-register. Talk-in on 147.03 and 224.96 MHz rptrs. For info call *(410) 467-4634*, or write: *BRATS Hamfest, P.O. Box 5915, Baltimore MD 21208.*

JULY 30-31

MANISTIQUE, MI The "93" U.P. Hamfest will be held at the Schoolcraft County Fair Building, Sat., July 31st, 6 AM-5 PM. There will be a Fish Fry Fri. night. Contact *Debra K. Barton WB8IBT, eves., (906) 341-5694;* or write *M.A.R.A., P.O. Box 144, Manistique MI 49854.*

JULY 30-AUG 1

REGINA, SASKATCHEWAN, CANADA Luther College at the University of Regina Campus will be the stage for "Regina Hamfest '93," sponsored by the Regina ARA. Address inquiries to: *Lyle Hopwood VE5HL, @VE5AGA.SK.CAN.NOAM, 4530 3rd Ave., Regina Saskatchewan S4S 0E8, Canada.*

AUG 1

SUGAR GROVE, IL The Fox River Radio League will hold a Hamfest at Waubonsee Community College starting at 8 AM. VE Exams at 10 AM. Talk-in on 144.87/145.47. Contact *Bill Schaben WA9AUW, (708) 208-4870;* or *Don Rasmussen N9III, (800) 472-7826.*

CROOKED LAKE, IN The annual Land of Lakes Angola Hamfest will be held at Steuben County 4-H Park, from 6 AM-1 PM. Talk-in on 147.180; packet 145.090; 444.350-131.8 tone; 224.94, 53.050. Contact *Land Of Lakes Angola Hamfest, Sharon Brown WD9DSP, 905 W. Parkway Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.*

SPECIAL EVENT STATIONS

JUNE 16-27

FT LAUDERDALE, FL N4PZN/MPS will operate from the manual-powered submarine races 1200Z-2400Z. Frequencies: SSB 14.230, 21.300, 28.500; FM - 146.300 simplex; CW - 7.110. Sponsored by AUTEC ARC, Andros, Bahamas.

JULY 4

THOMPSON, OH Station KD8FJ will operate (starting at 1400 UTC) from Heritage Hill Camp, in conjunction with the 7th "Heritage of Our Country" celebration. Operation will be in the lower portion of the 40m General phone band, and on 10m phone at 28.453 (if conditions allow). QSL with a large SASE to *KD8FJ, 386 Cedarbrook Dr., Painesville OH 44077-2849.*

JULY 8-11

WICHITA, KS The YLRL Convention will operate Station KB0FUN, on all bands, 1700Z July 8th thru 1600Z July 11th. QSL cards will be mailed to all stations worked.

JULY 9-11

NORTH DAKOTA, USA - MANITOBA, CANADA Station VE4IHF/0 will operate from the U.S. Lodge Internat'l Peace Garden during the Internat'l Hamfest. Frequencies: 3.937, 7.255, 14.255, 21.355, and 28.355. QSL with an SASE and a IRC or a green stamp, to *John Swanke KA0SLJ, Box 304, Lakota ND 58344.*

JULY 10

CAPE VINCENT, NY The Jefferson County RAC will operate N2JOA 1200Z-2400Z to celebrate the 25th Annual French Festival, commemorating our French heritage in Northern New York State. Operation will be in the lower General CW and SSB portion on 80m, 40m, 20m, and 15m, and the lower Novice CW and SSB portions on 10m. For a certificate, send QSL and SASE to *JCRAC, P.O. Box 523, Brownville NY 13615.*

ENDICOTT, NY Station KB2JZG will operate from 1300Z-1900Z, (in conjunction with a M1 Rifle Clinic) to recognize the US Dept. of the Army, Office of the Dir. of Civilian Marksmanship programs for firearms competence. Operation will be in the lower portions of the General 40m, 20m, and 10m phone subbands. For a certificate, send QSL and SASE to *M1 Special Event, P.O. Box 572 Union Station, Endicott NY 13760.*

JULY 10-11

FULTON, NY The Oswego County AR Emergency Service (ARES), will operate KY2F 1200Z-2100Z, each day, from the Central NY Internat'l Air Show at the Oswego County Airport. Operation will be in the middle of the General 80m, 40m, 20m, 15m, and 10m phone bands; the Novice portion of 10m; 147.75/.15 MHz; and packet on 144.91 MHz. For a certificate, send your QSL card and a large SASE to *Fred Swiatlowski KY2F, P.O. Box 5227, Oswego NY 13126.*

U.S./CANADA Amateurs affiliated with the American Sunbathing Assn, The Naturist Soc., and the Federation of Canadian Naturists, will be celebrating National Nude Weekend by operating a series of Special Event Stations at nudist parks and nude beach sites across the U.S. and Canada. Operation will be from 10 AM-3 PM local time on 40-2m. For a certificate, indicate all sites worked and send QSL(s) with a 9 x 12 SASE to *Naturist Society Amateur Radio SIG, Box 74A Ash Rd., Coatsville PA 19320.*

JULY 11

TATAMY, PA Tatamy PA will celebrate its 100th Anniversary, and will operate KA3OEG from 1400Z-2000Z as a part of the Centennial celebration. Frequencies: 3.965, 7.2675, 14.265, 21.365, 28.365. To get a certificate, send QSL info and a SASE to *KA3OEG, Box 193, Tatamy PA 18085.*

JULY 17

BATH, NY The Keuka Lake ARA, Inc., will operate AA2CJ, 1300Z-2400Z to commemorate Living History Day, as part of the Town of Bath's 200th Anniversary. Frequencies: CW - 3700, 7125, 28200; phone - 3875, 7240, 14250, 28400. For a certificate, send QSL and a 9 x 12 SASE to *Reginald Gehret N2MAH, 125 E. Washington, Bath NY 14810.*

JULY 17-18

STRATFORD, NY The Fulton County Historical Soc. will operate W2ZZJ 1400Z-2000Z, July 17th and 18th, to celebrate the 167th anniversary of the birth of Dr. Mahlon Loomis, the American wireless telegraphy pioneer, who was born at nearby Oppenheim. For a certificate, send QSL, contact #, and a #10 SASE ONLY to *W2ZZJ, HC Box 80, Stratford NY 13470.*

JULY 24-25

PORT HURON, MI The Eastern Michigan ARC will operate K8EPV 1400Z Jul 24-0200 Jul 25; 1400Z Jul 25; and 1400Z-0200Z Jul 26, to commemorate the 68th Port Huron to Macinac Island Yacht Race. Frequencies: CW - 3.710, 7.110, 21.110; SSB - 3.910, 7.262, 14.262, 21.312, 28.393. For a unique certificate, send QSL and 9 x 12 SASE to *K8EPV, 1640 Henry St., Port Huron MI 48060.*

PORT ORCHARD, WA Kitsap County ARES will operate AA7LP from 1700Z on July 24-0300Z July 25 (0900-2000 July 24 PDT) to celebrate the 20th anniversary of Silverdale Whaling Days. Operations will be on 28.330 MHz (USB) and 147.510 MHz (FM simplex). For a QSL card, send your QSL and an SASE to *Matt Amis AA7LP, 2196 California Ave. E, Port Orchard WA 98366.*

JULY 26-AUG 1

CANTON, OH The Canton ARC will operate Station W8AL (1000 UTC-0200 UTC) to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB - 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, and 3.870 MHz; CW - 28.125, 24.910, 21.125, 18.080, 14.050, 10.120, 7.125, and 3.700 +/- QRM. There will also be RTTY, packet, AMTOR, satellite, and 2-meter FM/SSB. SWLs are welcome. For an unfolded certificate, send your QSL with contact number and a 9 x 12 SASE, with two units of first-class postage. For a QSL or a folded certificate, send your QSL with contact number and a #10 (business size) SASE to *Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.*

JULY 30-AUG 1

WIESBASDEN, GERMANY CQ de Frankenstein!! The Wiesbaden ARC will operate Station DA1WA from 2000 UTC July 30-1200 UTC Aug. 1, on 80-10m in SSB, CW, and digital modes, from the famous castle near Darmstadt, during their 4th annual Castle Frankenstein DX-pedition. QSL via the bureau or direct with two or three IRCs or "Greenstamps" to *Robert Kipp DJ0PU, HügelstraBe 25, D-6070 Langen, Germany.*

JULY 30-AUG 8

MIDDLETOWN, OH The Dial ARC will operate club station W8BLV from the National Hot Air Balloon Championships, evenings and weekends. Frequencies: SSB - 3.965, 7.265, 14.265, 21.365, 28.365 and 2 meters. CW - 10 kHz from the bottom of Novice bands. For a special balloon QSL, send your QSL and a SASE to *Ernest Howard AG8Y, 4003 Lewis Street, Middletown OH 45044.*

AUG 2-8

GRAND HAVEN, MI Members of the North Ottawa ARC will operate K8AR 1200Z-2100Z Aug. 2-8, to commemorate the 203rd Anniversary of the U.S. Coast Guard from Coast Guard City USA. Operation will be in the bottom portion of the General phone subbands. For a certificate, send QSL card and a 9 x 12 SASE to *NOARC, P.O. Box 44, Ferrysburg MI 49049.*

AUG 12-14

GLENS FERRY, ID The Southern Idaho Hams will operate K7QQP to celebrate the Three Island crossing of the Oregon Trail. Operation will be on SSB - 75m, 40m, 20m 15m General portion; 10m Novice/Tech portion, Thurs. 1800Z-Sun. 0600Z, or as long as conditions last. For a 3 x 6 card, send your QSL card and an SASE to *Paul KB7QHH, 5107 Grover, Boise ID 83705.* RF

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

02D42 **Digital Novice** *by Jim Grubbs* Geared to make you a more knowledgable participant. **$8.50**

01A87 **Shortwave Listener's Antenna Handbook** Primer antenna theory. **$13.95**

05C25 **Basic A.C. Circuits** A step-by-step approach for the beginning student. **$24.50**

20N018 **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

20N092 **The Wonderful World of Ham Radio** *by Richard Skolnik, KB4LCS* Simple, clear, and fun. Introduces young people to amateur radio. **$7.95**

20N100 **Electronics Build and Learn (2nd Ed.)** *by RA Penfold* Combines theory and practice so that you can "learn by doing." **$12.50**

20N099 **Digital Electronics Projects for Beginners** *by Owen Bishop* Contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. **$12.50**

AR2073 **Novice Antenna Notebook** A beginners guide to easy and effective antennas and tuners you can build. **$9.50**

AR2871 **W1FB's Help for New Hams** *by Doug DeMaw W1FB* Complete for the newcomer. Put together a station and get on the air. **$10.00**

AR2286 **First Steps in Radio** *by Doug DeMaw W1FB* Series of *QST* articles. **$5.00**

SHORTWAVE

06S57 **1993 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$16.50**

03S11 **Shortwave Receivers Past and Present** *edited by Fred J. Osterman* Guide to 200+ shortwave receivers manufactured in the last 20 years. The Blue Book of shortwave radio value. **$8.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter.* Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

03C09 **Shortwave Clandestine Confidential** *by Gerry L. Dexter* Covers all clandestine broadcasting, country-by-country: tells frequencies, other unpublished information: spy, insurgents, freedom fighters, rebel, anarchist radio, secret radio. **$8.50**

03M221 **US Military Communications (Part 1)** US Military communication channels on shortwave. Covers frequencies, background on point-to-point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. **$12.95**

03M222 **US Military Communications (Part2)** Covers US Coast Guard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. **$12.95**

03M223 **US Military Communications (Part 3)** Completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. **$12.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

11T88 **Tune in on Telephone Calls** *by Tom Kneitel K2AES* Formatted as a frequency list with detailed description of each service and its location in RF spectrum. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations** *by J. Klingenfuss* Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial. Meteo, PTTs, embassies, and more. **$12.95**

11AS10 **Air Scan Guide to Aeronautical Communications (5th Ed.)** *by Tom Kneitel K2AES* Most comprehensive guide to monitoring US aeronautical communications. Covers all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. **$14.95**

15A002 **Scanner and Shortwave Answer Book** *by Bob Grove* Most frequently asked questions by hobbyists. **$13.95**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.)** *by Tom Kneitel K2AES* This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. **$19.95**

11F52 **Ferrell's Confidential Frequency List, New Revised Edition** *compiled by A.G. Halligey* All frequencies from 4 MHz-28MHz covering ship, embassy, areo, Volmet, Interpol, numbers. Air Force One/Two, more. **$19.50**

11SR97 **National Directory of Survival Radio Frequencies** *by Tom Kneitel K2AES* Handy and concise reference guide to high interest communications frequencies required by survivalists. **$8.95**

11SM11 **Scanner Modification Handbook, Vol. 1** *by Bill Creek* provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. **$17.95**

11EE06 **Guide to Embassy Espionage Communications** *by Tom Kneitel K2AES* Candid and probing examination of worldwide embassy and (alleged) espionage communications systems and networks. **$10.95**

15D93 **1993 Shortwave Directory (8th Ed.)** *by Bob Grove* Extensively revised, the new 1993 Shortwave Directory is the consummate DXer's bible for the first 30 MHz of radio spectrum, up-to-date and accurate. **$21.95**

20N094 **A Flick of the Switch, 1930-1950** *by Morgan E. McMahon* Discover the fast-growing hobby of radio collecting. **$8.95**

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11T89 **Scanner Modification Handbook Vol. 2** *by Bill Creek* Here it is—a companion to Vol. I. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new exciting modifications for popular scanners. **$17.95**

03R01 **World Press Services Frequencies (RTTY) New 5th Ed** A comprehensive manual covering radioteletype news monitoring—contains all information—antenna, receiving, terminal units, plus three extensive frequency lists. **$8.95**

ARRL BOOKS

AR1993 **ARRL 1993 Handbook (70th Ed.)** 39 chapters, featuring 2,100 tables, figures and charts. Comprehensive, well organized and affordable. **$25.00**

AR1086-4 **ARRL Operating Manual (4th Ed.)** Information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF. **$18.00**

AR0194 **Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. **$10.00**

AR2545 **Antenna Compendium Vol. 2** Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. **$12.00**

AR4017 **Antenna Compendium Vol. 3** More verticals, yagis, quads, plus loops, arrays, mobile, direction finding, controlled currents, computerized, installation, overloads, plus 40 new articles for beginner's to advanced. **$14.00**

AR2626 **Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **$10.00**

AR0488 **W1FB's Antenna Notebook** *by Doug DeMaw W1FB* Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$9.50**

AR0348 **QRP Notebook** *by Doug DeMaw W1FB* Presents construction projects for the QRP operator. **$9.50**

AR4141 **W1FB's Design Notebook** *by Doug DeMaw W1FB* Filled with simple practical projects that can be built using readily available components and common hand tools. **$10.00**

AR2200 **Antenna Impedance Matching** *by Wilfred N. Caron* Most comprehensive book written on using Smith Charts in solving impedance matching problems. **$15.00**

AR0402 **Solid State Design** Good, basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment. **$12.00**

AR3193 **Weather Satellite Handbook (4th Ed.)** *by Dr. Ralph Taggart WB8DQT* Expanded and revised to reflect today's weather-fax satellite technology. **$20.00**

AR3290 **Companion Software for Weather Satellite Handbook** 5 1/4" MS-DOS Floppy. **$10.00**

AR3291 **Now You're Talking! All You Need To Get Your First Ham Radio License (2nd Edition)** A complete study guide for the Technican and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. **$19.00**

AR3292 **Your Introduction to Morse Code: Practice Cassettes** Kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. **$10.00**

AR0437 **ARRL Repeater Directory 1993-1994** 19,000+ listings with digipeaters, bandplans, CTCSS (PL(TM)) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24GHz. **$6.00**

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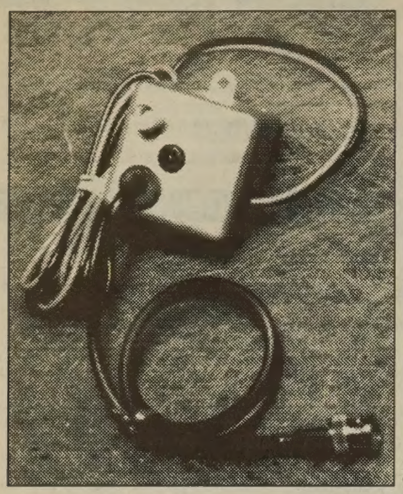


ELECTRON PROCESSING

Electron Processing, Inc. has announced a unique solution to scanner damage caused by nearby transmitters. The "SCANR SAVER" installs easily in the antenna line of the scanner and when it senses radio signals strong enough to cause damage it disconnects the scanner from the antenna, thus preventing damage to the scanner's sensitive "front end" receiver circuits. With the SCANR SAVER, amateur radio operators and others can use their transceivers without worry about damaging their scanners during transmissions. The SCANR SAVR can be used to protect mobile or base station scanners.

The SCANR SAVR is housed in a 2-inch-square metal box that mounts near your scanner and connects via BNC connectors. Signals within the range of 15 MHz to 2000 MHz are detected by the sensing circuit which has an adjustable trip point allowing the unit to be adjusted to correspond with the overload characteristics of any model scanner.

For the price and more information, contact *Electron Processing, Inc. P.O. Box 68 Cedar MI 49621; (616) 228-7020.* Or circle Reader Service No. 201.

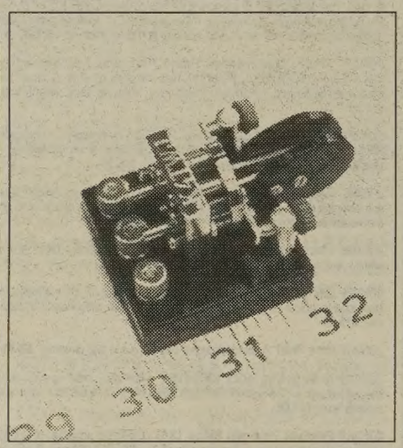
G4ZPY

G4ZPY has introduced the handcrafted "3-in-1 miniature twin-lever paddle." Although the 3-in-1 is perfect for home station use, it is specially designed for QRP, mobile, and backpacking applications.

This pocket-size paddle consists of a highly polished brass mechanism assembled with chrome screws and fitted with tiny oval black fingerpieces. This design gives the 3-in-1 the same feel as a full-size iambic paddle.

As an extra feature, your call is professionally engraved atop the yoke's rear plate at no additional cost. The 3-in-1 paddle's lower layer is a rubber magnet for securing the paddle to a metal object or to an auto's gearshift lever. Black tape and Velcro fasteners are included for knee-strap mobile operation.

The U.S. introductory price is £70 (U.K.) including postage and insurance. Orders are accepted via telephone or mail, with dollar-to-pound conversion established in the exchange. For more information, contact G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough, Ormskirk, L40 7TG England; 011 0704 894299. Please include an SASE and two IRCs for the brochure. In the U.S., brochures (only) are available from K4TWJ/Dave Ingram, 4941 Scenic View Drive, Birmingham AL 35210. Please include an SASE with two stamps for a reply.



GORDON WEST WB6NOA

Amateur radio operators wishing to upgrade to Advanced Class may now obtain the 173-page FCC license preparation book, written by well-known instructor Gordon West WB6NOA. The Advanced book covers all 507 examination questions—each with four possible answers and West's unique explanation style.

"My new Advanced book eliminates the need for students to jump back and forth between the front and back of other books to find the solutions and correct answers," says West.

"The Advanced book tells you exactly what to bring to the VE test session," comments a recent graduate. "The book even contains a tear-out page of formulas, too—and this really helps."

The price is $9.95. The Advanced Class FCC license preparation book is available through most amateur radio dealers, or mail order from the W5YI Group. For information contact *Master Publishing, 2414 College Drive, Costa Mesa CA 92626; (800) 669-9594.* Or circle Reader Service No. 202.

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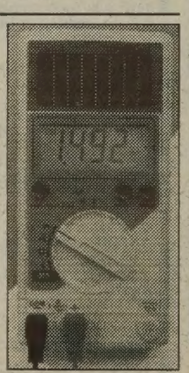
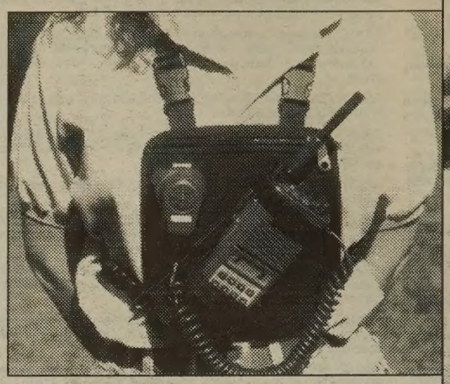
Imagine owning a solar-powered digital multimeter! State-of-the-art "polymer" lithium batteries charged by a solar cell keep this versatile hand-held multimeter working from two to 10 hours on a one-hour charge from your workbench light, indirect outdoor light or direct sunlight.

The unit measures up to 20 megohms and its features include: continuous monitoring of battery charge, continuity beeper/diode check, and fuse protection in the milliamp ranges.

The price is $95 plus $4.50 shipping and handling (only Californians need to include sales tax). For further information or to order, contact *Front Row Experience, 540 Discovery Bay Blvd., Byron CA 94514-9454; 1-800-524-9091.* Or circle Reader Service No. 205.





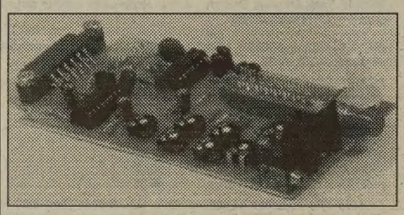
EMARS

EMARS has introduced two new products which can give you a choice in carrrying that new handie-talkie: the ECW-050 Belt Harness and the MAW-100 Chest Harness. Both of these harnesses are made in the USA out of 1000 Denier Padded Cordura®, which is weatherproof and is not affected by salt spray or perspiration. The radio pouches on both harnesses are universally adjustable to fit nearly any size or make of portable radio.

The ECW-050 Belt Harness holds the radio securely on the belt and out of the way for full freedom of movement. It is also useful for attaching the HT onto the handlebars of a bicycle.

The MAW-100 Chest Harness allows for hands-free listening without an earpiece. It has a zippered, paddded pocket for pens, note pads, extra battery packs or other items, and has an auxiliary microphone attachment.

The ECW-050 Belt Harness is $18.95 and the MAW-100 Chest Harness is $29.95, plus $3.50 shipping and handling. For more information, or to order either harness, contact: EMARS, P.O. Box 781204, San Antonio TX 78278-1204; (210) 493-7546. Or circle Reader Service No. 203.



MFJ

MFJ Enterprises, Inc. announces the fastest, easiest, and least expensive way yet to join packet action: the new MFJ-1271 TNC. If you have a Commodore 64/128 computer and a VHF hand-held or HF SSB transceiver, this is the only item you will need to add!

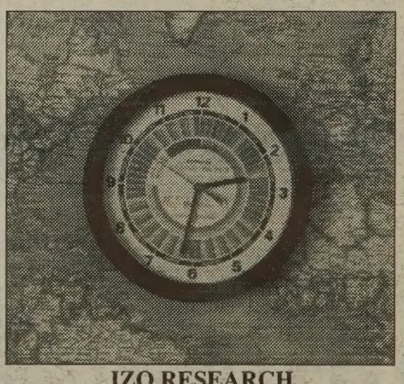
It works both VHF packet at 1200 baud and HF packet at 300 baud. This is a true high performance modem/TNC with a DCD circuit and an adjustable threshold control. It uses MFJ's famous Digicom/64 public software.

The price is $49.95, and it comes with a one-year unconditional guarantee. For more information or to order, visit an MFJ dealer or contact: *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-5869, FAX: (601) 323-6551, Telex: (601) 323-6551 or order toll-free at 1-800-647-1800.* Or circle Reader Service No. 204.

FBENTERPRISES

FBenterprises announces an improved selection of repeater maps. The (5-1/2" x 8-1/2") 2 meter maps are encased in plastic and are printed in full color. The bands between 220 and 1.2 GHz are on the back. They are available for all 50 U.S. states, all Canadian provinces, Central American countries, and Caribbean islands. (California is split into Northern and Southern California, so please specify which part.)

The price is $3.95 and they are sold by mail order or through dealers. For information or to order contact *FBenterprises, 15800 NW 31st Ct., Vancouver WA 98685; (206) 573-0910 phone or FAX.* Or circle Reader Service No. 206.



JZO RESEARCH

The new Spectra-Com Universal Time Piece combines WWV time and frequency services information from the National Institute of Science and Technology with an analog clock. It shows WWV events and local or universal time with precision in a 12- and 24-hour format.

The information is displayed with quartz accuracy (+/- 1 second) on a colorful dial. Its beautifully crafted display is designed in distinctive red, white, blue, yellow, and black for ease of use. The unit uses one AA battery (not included) which lasts for more than a year.

The limited introductory price is $29.95 plus $4.50 S&H (in Minnesota add 6.5% sales tax). For further information or to order, contact *JZO RESEARCH, 7140 Colorado Avenue North, Minneapolis, MN 55429.* Or circle Reader Service No. 207.

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